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ABSTRACT

The Australasian Association for Institutional Research (AAIR) conference provided a comprehensive coverage of issues, concepts, and techniques in the areas of planning, data analysis and research, and related aspects of management support in tertiary education. Refereed papers from the conference include: (1) "Changes in Student Approaches to Study at CPHK (City Polytechnic of Hong Kong); "A 3-Year Longitudinal Study" (J. Balla, M. Stokes, and K. Stafford); (2) "Study of Student Costs Using Activity Based Costing Methodology" (K. Doyle); (3) "A Survey of Environmental Scanning in U.S. Technical and Community Colleges" (J. N. Friedel, J. T. Blong, and D. R. Coker); (4) "Comparative Efficiency of Australian University Departments of Accounting" (D. Gadenne and B. Cameron); (5) "Strategic Planning and Resource Planning in an Institution with a Limited Discretionary Income" (T. Grigg and R. Sharma); (6) "Limited Entry and Managed Entry: "Ad Hoc" Responses at the Departmental Level to the Student Numbers Problem" (S. Hunter); (7) "Faculty Development through Collegial Strategic Planning" (D. J. Lloyd); (8) "Reflection and Future Direction in Tertiary Education: Australia's Educational Reforms" (G. C. Ng, C. Pantazis, and R. Sharma); (9) "A Comparison of the Academic Success of Mature Age and Traditional Entrants at the Victorian College of Agriculture and Horticulture--Dookie Campus" (M. Parameswaran); (10) "Award Restructuring and Articulated Engineering Education" (S. Prathapan); (11) "Space Planning and Utilization in Tertiary Education" (R. Sharma); (12) "Planning and Total Quality Management" (R. Vasudeva); (13) "Computerized Enrollment and Timetabling at the University of Sydney" (J. Ward); and (14) "The Planning and Development of an Integrated Research Information System in a University" (A. L. Wong). Additional papers, not refereed for publication, were delivered. An appendix provides background on the AAIR. (SLD)

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1991 AAIR FORUM

Conference of the AUSTRALASIAN ASSOCIATION FOR INSTITUTIONAL RESEARCH (AAIR)

TUESDAY 1 OCTOBER 1991 - THURSDAY 3 OCTOBER 1991

Hosted by

SWINBURNE INSTITUTE OF TECHNOLOGY
HAWTHORN, VICTORIA, AUSTRALIA

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1991 AAIR CONFERENCE
1 - 3 OCTOBER 1991

CONFERENCE OF THE
AUSTRALASIAN ASSOCIATION FOR INSTITUTIONAL RESEARCH (AAIR)

FROM THE CHAIR OF THE 1991 AAIR CONFERENCE

As the host of the second conference of the Australasian Association for Institutional Research, Swinburne is pleased to provide the Refereed Proceedings of the 1991 AAIR Conference.

The development of the AAIR has been an important aim within our region and Swinburne is proud to support this endeavour with the publication of refereed presented papers from the conference.

The conference was actively supported by many people including the AAIR Executive Committee members who, together with a number of the AAIR local members, made valuable contributions to the organisation and delivery.

I would also take this opportunity to convey my thanks to our invited keynote speakers, panelists both from within Australia and overseas who contributed their time, energy and expertise to the conference. Equally, I would like to thank the presenters of the parallel sessions, demonstrations and pre-conference workshops. Their efforts have enabled the program to meet the developmental needs of institutional researchers in our region.

I thank them for their planning and congratulate them on the success of the conference.

Congratulations is also due to the Conference Secretary and members of the organising committees who so ably undertook the task of the conference planning and implementation..

In closing, I hope these proceedings provide a reference for continuing professional development and association with AAIR.

F G Bannon
Associate Director
Swinburne Institute of Technology

INTRODUCTORY COMMENTS FROM THE PRESIDENT OF AAIR

The Australasian Association for Institutional Research (AAIR)

The Australasian Association for Institutional Research (AAIR), established in 1988, is affiliated with the International Association for Institutional Research (AIR) founded in the United States of America some 30 years ago.

The broad aim of AAIR is to benefit, assist and advance research leading to improved understanding, planning and operation of tertiary education institutions within Australasia.

Background information on AAIR is provided in the appendix of this volume.

The AAIR Annual Conference

The annual Conference is a key strategy in the association's fundamental aims as a professional body.

The second AAIR Conference was hosted by the Swinburne Institute of Technology in Melbourne from 1 - 3 October 1991. Offering a unique opportunity within the Australasian region for delegates interested in institutional research to take part in a program dedicated to the professional concerns of AAIR membership. The program provided a comprehensive coverage of issues, concepts and techniques in the areas of planning, data analysis and research and related aspects of management support in tertiary education.

Refereed Proceedings of the 1991 Conference

This publication provides refereed proceedings of the second (1991) AAIR Conference and includes most, but not all, of the papers presented at the AAIR Conference. As the submission of papers for inclusion in the refereed proceedings was not compulsory some of the paper presenters have elected not to submit their works for refereed publication. Their papers were distributed to delegates during the conference.

A special issue of the AAIR Newsletter will include articles on keynote addresses and plenary sessions of the 1991 AAIR Conference.

Dr Raj Sharma
Swinburne Institute of Technology

October 1991

For further information about the Australasian Association for Institutional Research and the 1991 AAIR Conference and its proceedings, please contact:

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For information about the 1992 AAIR Conference to be held in Auckland, New Zealand over 25 to 27 November 1992 contact:

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PROGRAM OUTLINE - 1991 AAIR CONFERENCE

Monday, 30 September

9.30 am - 4.30 pm — **Workshop:** Andrew Kemp, Siva Sivagnanam, Ian Watkins, SAS Representatives

Electronic Communication and SAS for Institutional Researchers

Tuesday, 1 October

9.30 am - 12.00 noon — **Workshop:** Dr Hans Ladanyi

Executive and Strategic Information Systems

12.00 noon - 2.00 pm — **Conference Registration/Demonstration of Tertiary Education Software**

2.00 pm — **Welcome:** by Professor Iain Wallace, Director, Swinburne Institute of Technology

2.15 pm — **Opening address:** by the Honourable Peter Baldwin MP, Minister for Higher Education and Employment Services (Australia)

3.00 pm — **Afternoon tea**

3.30 pm — **Keynote address:** Professor Leo West
National Board of Employment, Education and Training

Technology, Communication and Techniques: their Impact on Higher Education Institutional Research

4.30 pm — **AAIR Annual General Meeting**

7.30 pm — **Conference Dinner:** at the Hilton Hotel

Wednesday, 2 October

9.00 am - 12.30 pm — **Parallel Sessions:**
Presentation of contributed papers/panel sessions on the following three tracks:

* Space Planning and Management (DEET Panel Session)/Resource Planning
* Decision Support Systems
* TAFE Planning and Management

10.30 am — **Morning Tea**

12.30 pm	**Lunch/Demonstrations**
2.00 pm	**Keynote address:** Mr Doug Smith Acting General Manager, State Training Board, Victoria *Current and Future Demands on Institutional Researchers: a TAFE Chief Executive Officer's Perspective*
3.30 pm	**Afternoon tea**
4.00 pm - 5.30 pm	**Parallel sessions:** Presentation of contributed papers/panel sessions on the following three tracks: * Performance Indicators (DEET Panel Session) * Academic Planning * Relevance of Institutional Research to Vocational Education and Training (TAFE) (DEET Panel Session)

Thursday, 3 October

9.30 am to 12.30 pm	**Parallel sessions:** Presentation of contributed papers/panel sessions on the following three tracks: * Research Management and Planning (DEET Panel Session) * Strategic Planning and Management * Enrolment Planning and Management
10.30 am	**Morning tea**
12.30 pm	**Lunch/Demonstrations**
2.00 pm	**Plenary session:** Dr Hans Ladanyi University of Maine at Presque Isle, USA Dr Raj Sharma Planning and Information Services Manager Swinburne Institute of Technology Mr Bruce Phillipps Deputy Principal and Executive Director (Academic) Wellington Polytechnic, New Zealand *Technology, Communication and Techniques: future directions for Institutional Research*
3.00 pm	**Advice on 1992 AAIR Conference** Mr Bruce Phillipps (Vice-President, AAIR)
3.15 pm	**Closing address** Mr Frank Bannon, Associate Director, Swinburne Institute and 1991 AAIR Conference Chair
3.30 pm	**Close of the 1991 AAIR Conference**

PARALLEL SESSIONS - LIST OF PRESENTATIONS

Wednesday, 2 October, 9.00 am - 12.30 pm

Track 1: DEET Panel Session on Space Planning/Resource Planning

Chair: Mr Con Pantazis
Assistant Director, Prahran College of TAFE

Panel: Mr Graham Gallas
Director, Capital Grants, Higher Education Grants and Finance Branch, Department of Employment, Education and Training

Mr Phil Westwood
Deputy Bursar (Buildings and Grounds), University of Sydney

Mr Robert Taylor
Planning Officer, Footscray Institute of Technology (VUT)

* *Space Planning and Utilisation in Tertiary Education*
Dr Raj Sharma, Planning and Information Services Manager, Swinburne Institute of Technology

* *Comparative Efficiency of Australian University Departments of Accounting*
Mr David Gadenne, Lecturer, School of Accounting, Queensland University of Technology
Mr Barry Cameron, Academic Staff Development Unit, Queensland University of Technology

* *Study of Student Costs Using Activity Based Costing Methodology*
Dr K Doyle, Director of Planning, University of Technology - Sydney

Track 2: Decision Support Systems

Chair: Mr Terry Hand
Planning Manager, University of New South Wales

* *The Structuring of Executive Support Systems for Higher Education*
Mr N Hughes, Director-Adminstration, University College of Southern Queensland

* *The Use of Excel in the Provision of Management Information*
Dr R Rate, Head, Department of Institutional Research and Statistics, Edith Cowan University

* *Strategic Management and Student Tracking Systems at the University of Maine at Presque Isle*
Dr H Ladanyi, Director, Institutional and Small Business Research, University of Maine at Presque Isle.

- *The Planning and Development of an Integrated Research Information System in a University*
  Mrs A L Wong, Head of the Planning Services Unit and Deputy Director of the Computer Centre, National University of Singapore.

Track 3: TAFE Planning and Management

Chair: **Ms Joan Burns**
Senior Organisation Analyst, Sydney Water Board

- *TAFE Teaching Loads and Staff Utilisation*
  Dr Alan Wickenton, Director, Richmond College of TAFE

- *Award Restructuring and Articulated Engineering Education*
  Mr S Prathapan, Deputy Director, Northern Territory University - Institute of TAFE

Wednesday, 2 October, 4.00 pm - 5.30 pm

Track 1: DEET Panel Session: Performance Indicators

Chair: **Dr Raj Sharma**
AAIR President and Planning and Information Services Manager, Swinburne Institute of Technology

Panel: **Dr Earl Dudley**
Director, Grants Policy, Higher Education and Finance Branch
Department of Employment, Education and Training

Dr Lindsay MacKay
Associate Director (Administration) and Head of Burwood Campus, Victoria College

Dr Nigel Smart
Executive Director, Planning, Victorian Post-Secondary Education Commission

Track 2: Relevance and Scope of Institutional Research in Vocational Education and Training (TAFE)

Chair: **Mr Bruce Phillipps**
Deputy Director, Wellington Polytechnic, New Zealand

Panel: **Mr Peter Dowling**
Vocational Education and Training Division, Department of Employment, Education and Training

Mr Bob Bangay
Associate Director (TAFE), Royal Melbourne Institute of Technology

Ms Kath White
Assistant Director - Services, Northern Metropolitan College of TAFE

Track 3: Academic Planning

Chair: Mr Bruce Zimmer
Executive Assistant (Chancellery), University College of Central Queensland

- *Planning and Total Quality Management*
  Dr R Vasudeva, Head, Department of Mathematics, Royal Melbourne Institute of Technology

- *Enhancing Academic Productivity, Innovation, Technology in the Academic Sector*
  Ms Kim Grey, Statistics Unit, Administration, University of Tasmania

- *Changes in Student Approaches to Study at CPHK: A 3-year longitudinal study*
  Dr John Balla, Management Information Office, City Polytechnic of Hong Kong
  Dr M Stokes, Department of Applied Science, City Polytechnic of Hong Kong
  Mr K Stafford, Educational Technology Centre, City Polytechnic of Hong Kong

Thursday, 3 October, 9.00 am - 12.30 pm

Track 1: DEET Panel Session on Research Management and Planning

Chair: Professor Iain Wallace
Director, Swinburne Institute of Technology

Panel: Dr Tony Gallagher
Director, Research Training, Department of Employment, Education and Training

Professor Paul Clark
Pro Vice-Chancellor (Research and Graduate Studies) and Acting Director, Victoria University of Technology

Ms M Robb
Manager, Research Office, University of New South Wales

Track 2: Strategic Planning and Management

Chair: Dr Gan Che Ng
Secretary AAIR and Lecturer, Department of Social Sciences, La Trobe College of Northern Victoria

- *Strategic Planning and Resource Planning in an Institution with Limited Discretionary Income*
  Dr Tony Grigg, Deputy Human Resources Manager, Swinburne Institute of Technology
  Dr Raj Sharma, Planning and Information Services Manager, Swinburne Institute of Technology

- *The Role of Institutional Research in Supporting Processes of Strategic Change*
  Mr Bruce Zimmer, Executive Assistant, University College of Central Queensland

- *Future Directions in Tertiary Education: Reflections of Australia's Educational Reforms in the Information Age*
  Dr Gan Che Ng, Lecturer, Faculty of Arts, La Trobe University College of Northern Victoria
  Mr Con Pantazis, Assistant Director, Educational and Administrative Services Centre, Prahran College of TAFE
  Dr Raj Sharma, Planning and Information Services Manager, Swinburne Institute of Technology

- *Faculty Development through Collegial Strategic Planning*
  Dr Doug Lloyd, Dean, Faculty of Education, La Trobe University College of Northern Victoria

- *A Survey of Environmental Scanning in US Technical and Community Colleges*
  Dr J Friedel, Associate Vice-Chancellor, Academic Affairs and Planning, Eastern Iowa Community College District, USA
  Mr J Blong, Chancellor, Eastern Iowa Community College District, USA
  Dr D Coker, Institutional Research Manager, Eastern Iowa Community College District, USA

Track 3: Enrolment Planning and Management

Chair: Mr Dennis Ham
Statistician, Curtin University of Technology

- *Limited Entry and Managed Entry: Ad Hoc Responses at the Department Level to the Student Numbers Problem*
  Dr Sally Hunter, University of Canterbury

- *Getting Over Not Getting In?*
  Mr Bevin Pope, Coordinator of Planning and Research, Queensland Office for Higher Education
  Mr Barry Cameron, Academic Staff Development, Queensland University of Technology.

- *A Comparison of the Academic Successes of Mature Age and Traditional Entrance at the Victorian College of Agriculture and Horticulture - Dookie Campus*
  Dr M Parameswaran, Lecturer in Agricultural Science, Victorian College of Agriculture and Horticulture.

- *Computerized Enrolments and Timetabling at the University of Sydney*
  Dr J Ward, School of Mathematics and Statistics, University of Sydney.

Changes in student approaches to study at CPHK:

a 3-year longitudinal study

Dr. J. Balla

Management Information Office

Dr. M. Stokes

Department of Applied Science

and

Mr. K. Stafford

Educational Technology Centre

ABSTRACT

The aims of tertiary institutions can be operationalised in terms of the aims and objectives of courses offered to students. These aims and objectives are often expressed in terms of the expected characteristics and skills possessed by students who have successfully completed the course of study. This paper presents an examination of students' perceptions of their approach to study, using Biggs' Study Process Questionnaire, on entry to six courses of study and at yearly intervals until completion. Particular attention is drawn to whether any changes found to occur in student learning approaches during a course of study correspond to the intentions of course presenters as expressed through those documented course aims that relate to student learning approaches. Further, analyses of a number of contextual variables are used to assist in the interpretation of findings in attempt to contribute to course evaluation and review.

Paper for presentation at the AAIR 1991 Conference, Melbourne, Australia, October 1-3, 1991.

In Hong Kong, over the next five years the number of first-year degree places is planned to double in order to provide tertiary places to nearly 25% of the relevant age group (The Governor's Speech, 1989). The City Polytechnic of Hong Kong (CPHK) is a relatively new and fast-growing institution, currently at the forefront of government expansion plans, where the issues of increased access are being addressed. Axiomatically, students entering the tertiary system in the future will be drawn from a wider range of backgrounds and over a wider range of abilities.

A large proportion of the stated aims of the courses offered at CPHK, and indeed those of higher education generally, are linked to processing skills (see Stokes, Balla & Stafford, 1989b). Additionally, it is the lack of acquisition of these skills with regard to learning management that is generally associated with poor student performance and failure. As traditional examinations are often questioned as a genuine test of such skills, it would seem logical to seek some independent indication of whether these course aims are being achieved. To this end a systematic study has been instituted at CPHK whereby the the approaches to study of students entering the institution are screened and then monitored at selected stages during their course of study. The question as to whether the students of the future, entering under conditions of greater access, display different motivation for learning and strategies for study can then be tested against the historical data presented in this report.

Research of student approaches to study has produced a diverse, international literature emerging essentially from the work of Biggs (1979), Entwistle and Ramsden (1983), Marton and Saljo (1976) and Pask (1976). From this diverse beginning, a polarisation has developed between research methodologies employing questionnaire-based data collection and those based on phenomenography. The two methodologies have produced strikingly similar classifications with common agreement on the existence of a deep or meaning orientation and a surface or reproducing orientation in most student groups. There have also been attempts to include notions related to vocational aspirations or the drive for paper qualification, excellence and strategic switching between approaches to maximise success, into a third achievement orientation. Arguably, these attempts have been subject to rather less agreement.

The questionnaire-based approach attempts to quantify the approaches to study of a large student sample. Two questionnaires - the Study Process Questionnaire (SPQ) (Biggs, 1987) and the Approaches to Study Inventory (ASI) (Entwistle and Ramsden, 1983) - have been the most widely used. The SPQ has been used in a number of studies in Australia and the U.K. (see for example Biggs, 1979; O'Neil and Child, 1984; Watkins and Hattie, 1981) and more recently in Hong Kong (see Balla, Biggs & Gibson, 1988; Gow and Kember, 1990a; and Stokes, Balla & Stafford, 1989a). The ASI (or sections of it) has also been used in Europe (see Entwistle and co-workers) and in Australia (see Clark, 1986; Kember and Harper, 1987; and Prosser and Tigwell, 1990).

To date, the large majority of these studies have focussed on differences in approach across and within student samples. In this respect, the present study is importantly different. The study is longitudinal where the focus is placed instead on changes in approaches to study over the entire course.

The SPQ has been selected for use in the study as it has been developed with the view of assessing an integral component of Biggs' concept of learning, that is, student perceptions of their approach to study. Biggs' framework (Biggs, 1987) provides a concise conceptualisation of the learning process as involving interaction between personal, background factors and situational or contextual ones. The model acknowledges, on the one hand, the importance of student prior experiences, skills and future expectations, and, on the other, the impact of the student's perceptions of the educational/institutional context in which they are situated. The model is dynamic in that as students continue to interact with the learning environment, motivational priorities may change and/or different strategies may be adopted. Employing the SPQ longitudinally enables the dynamics in evidence during a course of study to be monitored and indeed provides a test of whether the findings match the intentions of course teams.

Students at entry

Students normally enter full-time degree programs at CPHK on completion of Advanced Level Examinations taken at the end of secondary schooling. At this stage in their educational careers the

students have experienced at least 12 years of schooling and have satisfied entry to a specific course of study. There are differences in the educational background of students entering differing courses (i.e. Maths/Science or Arts/Economics) and certain courses (e.g. Electronic Engineering (EE), Building and Construction (BC) and Applied Physics (AP)) only admit students with certain pre-requisite experiences (see Balla, Stokes & Stafford, 1989). It is conceivable, that given the pre-requisites required for entry to some courses that students' perceptions of their motives and strategies may well be different entering tertiary study. In fact, Watkins & Hattie (1981) report such differences for studies carried out Australia. Alternatively, it may be argued that the students all represent successes of the secondary system (with many common experiences) and as such may share motives and strategies. Indeed, analyses undertaken to date (see Stokes, et al., 1989b) reveal no differences in motivation and strategies between students entering degree courses at CPHK with different secondary experiences.

Students during their years of study

During the three years of tertiary life the students will have had an added experience of instruction in their chosen course of study. Specific courses plan to achieve a variety of identified aims, brought about by structuring content and learning activities so as to promote appropriate approaches to study. An analysis of the aims and objectives of the courses participating in the current study revealed that the objectives can be broadly categorised as those relating to the acquisition of knowledge and skills and those relating to the development of an understanding of concepts and relationships between

concepts. Taken together the student in degree programmes should then be able to apply these skills to novel situations or solve problems that may arise in their future employment situations. At the extremes then, curriculum created for degree courses at CPHK exhibit characteristics relating to the acquisition of knowledge and skills and the achievement of higher order skills. Extracts from the curriculum documentation support this contention as follows:

Knowledge & Skills

To develop comprehensive knowledge and understanding of the physical phenomena that underlie both materials science, and physical measurement techniques and their applications (Applied Physics (AP)

To develop the student's understanding and competence .... relevant to building (Building and Construction (BC))

To give a thorough grounding in business disciplines and functions (Business and Management (BM))

To equip students with sufficient professional knowledge in electronic engineering to enable them to function as electronic engineers upon graduation (Electronic Engineering (EE))

Obtaining a thorough knowledge of the law and legal system of Hong Kong (Law)

To develop students' operational skills for the practice of public and social administration (Public and Social Administration (PSA))

Higher Level Skills

Extracts from the course documentation also stress the importance of developing higher level skills. There are clear statements in course documentation that emphasise "problem-solving" approaches that require "independent learning" and/or "creative thinking", the development of analytical skills and/or design capability, and the ability to cope with change. The following sample of major course aims illustrate the point:

To develop the ability to approach and critically evaluate new problems. (AP)

to stimulate the student to develop an enquiring, analytical and creative approach to the study of building while encouraging the habit of independent judgement and critical awareness. (BC)

to develop the intellectual and analytical capabilities essential to success in the modern changing business environment. (BM)

to present opportunities for the student to think creatively and independently and hence make a realistic estimate of his own potential. (EE)

developing skills of legal analysis and reasoning. (Law)

to develop students' intellectual and analytical capabilities necessary for effective performance in a changing public and social administration field. (PSA)

Unplanned, unidentified aims will also be achieved as students respond to the "hidden curriculum" and attempt to satisfy their own individual objectives. The literature identifies assessment (see Bowden, Masters & Ramsden, 1987; Clarke, 1986; Clift and Willis, 1986; Entwistle and Ramsden, 1983; Newble and Jaeger, 1983) and workload (Entwistle and Ramsden, 1983; Kember and Harper, 1987) as two areas where "hidden" characteristics may significantly influence students approaches to study. This leads to three research questions:

(i) Are there any differences in the perceptions of students with regard to motives and strategies across different courses of study at CPHK at the four points monitored?

(ii) Are there any changes in the perceptions of students with regard to motives and strategies after over the three years of instruction at CPHK? and

(iii) Are there any differences in changes in motives/strategies across course of study during the three year experience?

In addition to the testable research questions outlined above, an effort is made to link observed changes with identifiable course characteristics, and in particular those associated with assessment and workload.

METHODOLOGY

The Study Process Questionnaire

Biggs devised the SPQ, over a number of years, to measure students' approaches to study along dimensions labelled "surface", "deep" and "achieving". The SPQ is comprised of 42 items constructed to measure six sub-scales - surface, deep, and achievement motivation (SM, DM & AM) and surface, deep, and achievement strategy (SS, DS & AS). The instrument was piloted and developed on western student samples and has been translated into Chinese for use in Hong Kong and was trialled by three research teams in Hong Kong resulting in a bilingual version.

Some general reservations have been expressed as to the validity of the surface scales (e.g. O'Neil and Child, 1984) and particularly for samples of eastern students (Kember and Gow, 1990; Watkins, Hattie & Astilla, 1986). Given these reservations the current authors have undertaken a systematic analysis of the items contained in the SPQ, its six apriori sub-scales and the underlying factor structure. The results of this analysis (see reference note 1) resulted in the specification of 8 additional sub-scales (see Table 1). In addition, there was a consistent identification of two factors: Deep Achieving (DM+DS+AS+AM); and Surface Achieving (SM+SS+AM) when imposing an apriori two factor stucture, suggested by Biggs (1987), on the data collected over three years.

Table 1. Additional sub-scales of the SPQ identified at CPHK

Interest:	This sub-scale is composed of six items (2, 14, 20, 26, 29 and 35) relating specifically to a students' interest in content material and satisfaction from studying. Four of these items are found in Biggs' Deep Motivation sub-scale and two in his Deep Strategy sub-scale.
Transfer of Knowledge:	This sub-scale is composed of five items (5, 11, 17, 23 and 41) all focussing on the extent to which students transfer knowledge in their studies (to enhance understanding). These items are in fact a subset of Biggs' Deep Strategy sub-scale.
Philosophy:	This sub-scale is made up of three items (8, 32 and 38) covering aspects related to personal philosophy and life goals. These are a sub-set of items from Biggs' Deep Motivation sub-scale.
Narrowness:	Two items (4, 22) from Biggs' surface strategy sub-scale relate specifically to narrowing or focussing study.
Anxiety:	Two items (7, 19) from Biggs' surface motivation sub-scale relate specifically to test anxiety and fear of failure.
Maintaining Face	Two items (34 and 40) from Biggs' Surface Strategy sub-scale refer specifically to a disposition to accept authority and maintain face which seemed particularly relevant to the chinese sample of students we were studying.
Credential /Job Orientation	This sub-scale is made up of two items (13 and 37). They specifically relate education to career prospects and the items come from the Biggs' Surface Motivation sub-scale. The extent to which students see themselves as predominantly seeking that paper qualification which will provide the basis for their future career paths seems a topical issue (see Gow & Kember, 1990b and Sharp, 1990).
Competitive	Three items (9, 15 & 33), a subset of Biggs'Achievement Motivation sub-scale indicate the extent to which students see themselves as competitive.
Note:	The item numbers refer to the bilingual version of Biggs' SPQ questionnaire but these are consistent with the item numbering in the instrument used for Western samples.

Sample for Investigation of Changes over the three Years

The sample is made up of full-time degree students at City Polytechnic from the departments of Business and Management (BM), Public and Social Administration (PSA), Electronic Engineering (EE), Building and Construction (BC), Applied Science (AP) and Law (LW). The first four departments have offered degree programmes for two or more years, whereas Applied Science and Law introduced their programmes in 1988. Students completed the SPQ at the beginning of term 1 and at the end of term 3 of their first year of study and the beginning of year 3 (term 7) and the end of year 3 (term 9). The numbers of students completing questionnaires in each of the programmes are summarised in Table 2. The differences in sample size shown in Table 2 from term 1 to term 9 are a result of late entry into a course, natural attrition or absence.

Table 2. Sample Size by Department for Repeated Measure

	1988		1990	
DEPARTMENT	TERM 1	TERM 3	TERM 7	TERM 9
Applied Science	61	59	56	55
Building & Construction	43	30	25	34
Business & Management	54	65	70	66
Electronic Engineering	36	40	27	33
Law	51	54	49	31
Public & Social Admin.	60	58	55	46
Total	305	306	282	265

Course Characteristics

Full-time, first degree courses at CPHK are all of three years duration. A course is administered by a parent department which generally offers a significant majority of the modules (units of study) making up the course. Other departments offer "service" modules at different times throughout the course. Table 3a-3b gives the number of modules required to be taken by students, sub-divided into those offered by the servicing departments and total number of modules in course. It is noticed that the Law course has the fewest number of modules offered by servicing departments and the amount of servicing declines as the students progress through the course.

Table 3a: Number of Modules Offered by Servicing Departments

	Year 1	Year 2	Year 3	Overall
Course				
BSc Hons (AP)	8	7	0	15
BSc (BC)	7	7	3	17
BA Hons (BM)	12	10	0-3	22-25
B.Eng Hons(EE)	7	4	3	14
LLB (Hons)	4	1	0	5
BA (PSA)	11	7	5	23

Table 3b: Number of Modules for Each Course (by Year)

	Year 1	Year 2	Year 3	Overall
Course				
AP	16+5(Lab)	15+6(Lab)	13+4(Lab)	44+15(Lab)
BC	15+9(Prac)	17+4(Prac)	17	49+13(Prac)
BM	18	17	15	50
EE	16+4(lab)	16+5(lab)	13+5(lab)	45+14(lab)
LAW	15	15	15	45
BA (PSA)	18	17	14	49

Table 4 presents data about examination load. Law and Applied Science courses required students to sit fewer examinations than other courses and it is interesting to note that of the six courses under study these two have been introduced most recently.

Table 4 Examination Workload over the Three Years of Course (by terms)

	Term 1	Term 3	Total
Year 1			
Course			
AP	3	6	9
BC	4	7	11
BM	5	10	15
EE	3	8	11
LAW	3	4	7
PSA	5	8	13
Year 2			
AP	1	6	7
BC	3	10	13
BM	4	8	12
EE	4	6	10
LAW	1	5	6
PSA	2	7	9
Year 3			
AP	0	5	5
BC	2	4	6
BM	0	4	4
EE	3	4	7
LAW	0	4	4
PSA	3	3	6
Total Course			
AP	4	17	21
BC	9	21	30
BM	9	22	31
EE	10	18	28
LAW	4	13	17
PSA	10	18	28

For the courses under investigation, all first-year modules are compulsory but do not contribute to the final award (other than for allowing progression into year 2). For all courses other than BC, 30% of the final course mark comes from year 2 modules while 70% comes from year 3 modules. In the case of BC only the results for year 3 modules count towards the final award.

RESULTS

Changes in Approach to Study during the Course of Study

The General Linear Models procedure (SAS, 1989) was used to undertake a repeated measures analysis of variance across the six courses being investigated for the two factors (deep and surface achievement), the six apriori sub-scales and the eight additional sub-scales described in Table 1.

As this is a repeated measures design, any missing data is eliminated from the analysis. Missing data resulted from students leaving the course, late entries to course (with advanced standing in year 2) and by students failing to enter identification on their response sheet. The percentages of students involved in the repeated measure averaged 45% over all courses but varied from 25% in the case of BM to 71% for AP. A summary of the findings from the repeated measures analyses of variance is presented in Table 5. Due to the number of tests undertaken the probability level for acceptance of a significant finding and further discussion is set at $p<.01$.

To illustrate overall trends for the combination of all six courses, means are provided, for the same set of scales, for the total sample at each sampling point (see Table 6).

Table 5. Summary of Findings of Repeated Measures Analysis of Variance:

Variable	T1	T3	T7	T9	CID	RM	INT
FACTORS							
DEEP ACHIEVING	-	-	-	-	-	**	-
SURFACE ACHIEVING	-	-	-	-	-	*	**
BIGGS' SUB-SCALES							
Deep Motivation	-	-	-	-	-	*	-
Deep Strategy	-	-	-	-	-	-	-
Achieving Strat.	-	-	-	-	-	**	-
Achievement Motivation	-	-	-	-	-	-	*
Surface Motiv.	-	-	-	-	-	*	-
Surface Strat.	-	-	-	-	-	**	-
ADDITIONAL SUB-SCALES							
Transfer of K.	-	-	*	-	-	-	-
Interest	-	-	-	-	-	**	*
Philosophy	-	-	-	-	-	**	-
Anxiety	-	-	-	-	-	-	-
Narrowness	-	-	-	-	-	**	-
Credential/Job	-	*	-	-	-	*	-
Maintaining Face	-	-	-	-	-	-	-
Competitive	-	-	-	*	-	-	-

KEY: T1: Term 1: Main Effect across Course at Term 1
T3: Term 3: Main Effect across Course at Term 3
T7: Term 7: Main Effect across Course at Term 7
T9: Term 9: Main Effect across Course at Term 9

CID: Main Effect across Courses (Term 1 to Term 9)
RM: Main Effect due to changes on the Repeated Measure
INT: Interaction of Course and Repeated Measure
* : $p<.05$ ** : $p<.01$

Table 6 Overall Means for Various Scales using Total Cohort Responses

	N=305	N=306	N=282	N=265
Scale	Term 1	Term 3	Term 7	Term 9
Deep Achiev.	89.52	86.71	85.99	84.52
Surf Achiev.	62.80	64.87	64.46	64.16
SM	21.48	22.22	22.43	21.84
DM	22.18	22.97	22.49	21.99
AM	21.86	21.78	21.51	21.56
SS	19.42	20.84	20.52	20.94
DS	23.20	22.39	22.46	22.29
AS	22.27	19.48	19.52	18.67
Competitive	9.73	9.61	9.34	9.42
Transfer	16.59	16.33	16.39	16.30
Philosophy	8.91	10.06	9.67	9.54
Interest	19.89	18.97	18.88	18.44
Narrowness	4.56	5.28	5.40	5.61
Main. Face	5.74	5.92	5.78	5.61
Anxiety	6.21	6.47	6.41	6.22
Job	7.55	7.48	7.46	7.14

Note: The sample size indicated at each sampling point is the maximum possible.

Changes in Factors

Deep Achieving

The means for each course on the deep achieving are provided in Table 7. Analyses revealed a significant repeated measures effect for this factor whereby there was a significant drop in deep achieving over the three years evidenced across all courses.

Table 7. Deep Achieving by Course & Term

		Deep Achieving			
		1988/89		1990/91	
Course	N	Term 1	Term 3	Term 7	Term 9
AP	44	87.84	85.66	84.07	85.05
BC	16	89.50	85.50	86.75	80.88
BM	23	85.96	87.09	87.00	85.83
EE	20	94.30	88.00	88.80	85.75
LW	22	89.32	90.95	87.50	88.55
PSA	39	91.13	87.02	87.36	87.18

Surface Achieving

The means on the surface achieving factor for the six courses are provided in Table 8. The repeated measures analyses of variance revealed a significant interaction which is illustrated in Figure 1. Students enrolled in LW seem to have increased their perceived level of surface achievement to be considerably higher than the overall average while students in EE corrected the increase resulting from year 1 instruction in years 2 and 3 to be considerably lower than the overall average.

Table 8 Surface Achieving by Course & Term

		Surface Achieving			
		1988/89		1990/91	
Course	N	Term 1	Term 3	Term 7	Term 9
AP	44	60.23	63.14	63.89	63.55
BC	16	65.81	62.25	65.13	64.19
BM	23	63.74	67.61	65.43	64.61
EE	20	66.30	67.80	64.85	64.35
LW	23	60.74	64.35	67.91	68.09
PSA	39	62.79	64.46	64.18	64.67

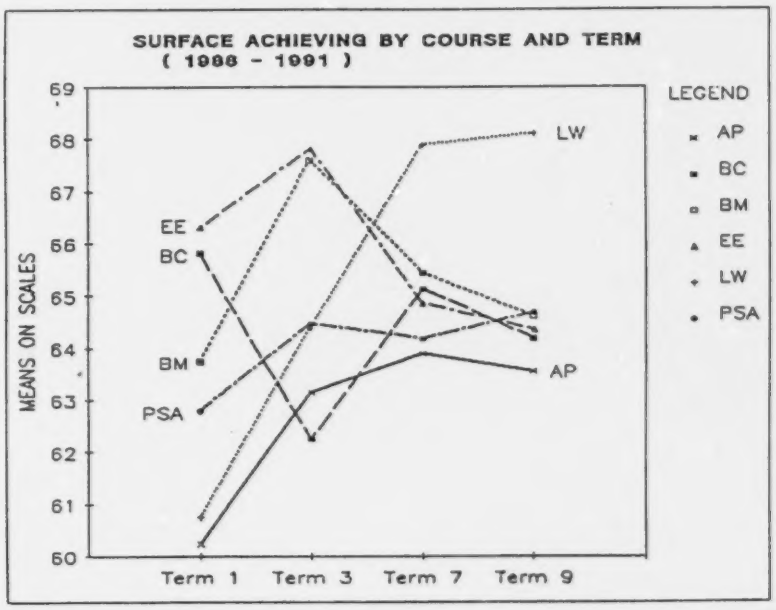

Figure 1. Interaction Effect of Surface Achieving across Course and Term.

Changes in Sub-Scales

Achievement Strategy or Study Skills

A significant main effect across the repeated measure was observed whereby there was a consistent drop in the use of study skills over the three years of study (see Table 9).

Table 9 Study Skills by Course & Term

Course	N	Term 1	Term 3	Term 7	Term 9
AP	47	21.87	20.53	20.17	20.17
BC	17	23.00	20.00	20.59	18.53
BM	23	21.96	19.52	20.22	18.74
EE	21	22.62	20.33	20.67	18.62
LW	22	22.72	20.50	19.04	20.22
PSA	39	22.51	18.74	19.31	18.61

Although, all items showed reduced means, analyses presented in Stokes et al. (1989b) and confirmed here reveal that this change is best exemplified by students indicating that by term 9 they were less likely to:

> work consistently throughout the term and review course material regularly as examinations approach.
>
> reread notes after a class session to make sure they are legible and understandable.
>
> complete assignments as soon as possible after they are given out.
>
> make a point of looking at most of the readings suggested during a class presentation.

The uniform drop in the use of such study habits across all courses seems to suggest a common experience during tertiary life, at least at CPHK, which compels this change in behaviour.

Surface Strategy

There was a significant increase in the use of surface strategy over the three years (see Table 10). However, the majority of this change seemed to be explained by the significant increase in the two items forming the narrowness sub-scale (see Table 11). Specifically, students perceive that they are more likely to :

> restrict their study to what is specifically set as they think it is unnecessary to do anything extra.
>
> .... think browsing around is a waste of time, so only study seriously what's given out in class or in the course outlines.

Table 10 Surface Strategy by Course & Term

Course	N	Term 1	Term 3	Term 7	Term 9
AP	47	19.38	20.89	21.43	21.26
BC	17	20.64	21.24	21.18	21.65
BM	23	19.83	21.65	20.43	20.43
EE	21	20.19	21.19	19.81	20.29
LW	23	18.39	20.56	21.43	21.39
PSA	39	19.36	20.44	20.44	20.64

Table 11: Narrowness by Course & Term.

		1988/89		1989/90	
Course	N	Term 1	Term 3	Term 7	Term 9
AP	49	4.63	5.39	6.06	5.73
BC	17	5.29	5.17	5.76	6.35
BM	23	4.52	5.70	5.26	5.22
EE	21	4.86	5.05	4.90	5.29
LW	23	4.52	5.04	5.70	6.26
PSA	42	4.33	5.10	5.43	5.48

The uniform change towards a narrower approach to study suggests that there may be some inherent characteristics of tertiary at CPHK that send common messages to students whatever their discipline.

Interest and Satisfaction

There was a significant drop in the "interest" subscale (see Table 12) over the period of the course.

Table 12 Interest and Satisfaction by Course & Term.

Course	N	Term 1	Term 3	Term 7	Term 9
AP	49	19.75	18.88	18.12	18.18
BC	17	19.59	18.88	18.00	17.71
BM	23	18.17	18.52	18.91	18.08
EE	21	21.10	18.10	20.33	19.57
LW	23	19.26	20.30	19.43	18.67
PSA	41	20.78	19.12	19.17	19.34

Philosophy

One sub-scale not to follow the downward trend of the Deep Achieving factor is the Philosophy sub-scale (Table 13). In fact, there was a significant increase in the means during the first year of study in 1988. An interesting observation here is that the readministration of the SPQ in term 3, 1988 occured quite soon after the events of June 4 in Beijing when the symbolic fight for democracy in China was lost and the ensuing student demonstrations in Hong Kong. It seems reasonable, therefore, to see a general increase in the response on this sub-scale as a consequence of such a traumatic external event.

Table 13: Philosophy by Course & Term.

Course	N	Term 1	Term 3	Term 7	Term 9
AP	47	9.19	9.57	9.51	9.60
BC	17	8.88	10.29	10.12	9.53
BM	23	8.09	9.30	9.48	9.87
EE	21	9.47	9.86	10.05	9.48
LW	23	8.70	10.43	8.78	8.56
PSA	41	8.95	10.68	10.27	10.07

Discussion and Conclusions

The changes in study approaches observed can be broadly conceptualised as a reduction in "good study habits" during year 1 and year 3, in particular, accompanied by a narrowing of the focus of study over the three year period. This increase in the narrowness dimension is seen to be consistent with the findings of Kember & Gow (1990) relating to a similarly named "narrowness dimension" of the ASI. Where these changes might be seen as responses to perceived course demands, it is interesting that the modification of study approach has taken place without any accompanying changes in the student's desire to perform optimally (achievement motivation or competitive sub-scales). Garner (1990) poses a convincing argument that if primitive routines get the job done then why continue with more acceptable and time-consuming study skills. She was referring to range of surface strategies as they might be used in reading and summarising. It seems equally plausible that if less sophisticated strategies allow the students to pass the exams set and continue in their credential hunt (see Sharp, 1990), which doesn't change appreciably during the course of study (job/credential sub-scale), then why should they engage in the more sophisticated procedures.

Concurrently, there is also a reduction in the students' intrinsic interest and satisfaction from studies over the three year period but no significant change in their commitment to transferring knowledge to a range of new situations (transfer sub-scale). Further, there is no significant change in their commitment to maintaining face by submitting to the lecturer's greater knowledge (maintaining face sub-scale). These three findings, taken together, would seem potentially disappointing to course teams.

We propose, that at CPHK, not unlike many other tertiary courses, the first year sets the ground-work for the second and third years. There is a lot of knowledge to be "crammed in" a short period of time. It might be argued that in year 1 of a three year degree programme, the relatively high number of courses to be taken (often presented by servicing departments) and the high proportion of "new factual knowledge" to be absorbed encourages the students to modify their approaches to study as observed. Indeed there is some evidence that certain courses have been consciously designed in this way, with attention to the development of higher order learning left to the second and third years. Such development, it is argued by the course designers, is best achieved only after a firm basis of facts, concepts and principles has been established. However, there seems to be no positive change in the strategies used by students, just further reduction in the use of good study skills, a further narrowing of focus and a decline in interest and satisfaction. The erosion of intrinsic interest in the course of study must lead to concern for educators at CPHK? For, it is well cited that individual interest contributes to enhanced performance of college level students (see Fransson, 1977; Prenzel, 1988 and Schiefele & Krapp, 1988). The logical corollary is that a reduction in interest may impede the quality of learning being undertaken in the course (Watkins & Hattie, 1990).

Garner (1990) also proposes that students will not use strategies that demand time and effort if they believe the strategies will not make any difference to the ultimate outcome. We would also like to extend the logic a little and propose that if time itself is a

constraint (through the overburdening of students) then it may not even get as far as choosing. The effect of workload on the choice of study strategy is well-documented and there seems to be evidence of a workload effect for a number of CPHK courses. At CPHK, the course designers were constrained and pressured by two major factors: first, the institution was new and its courses had to satisfy outside accrediting agencies (Council for National Accreditation and Awards); and second, the institution was committed to a modular system of instruction.

The oldest courses were developed when there was a lot of pressure to use modules "off the shelf" for economies of scale considerations. The extent of the servicing and workload factors were described earlier. In addition to the number of courses there is the question of how relevant the student's see the courses. This will be determined by such things as assessment policy (is it a compulsory pass module?) and also the extent to which it is tailored specifically for the course or simply "one off the shelf". That is, is the service module integrated into the total instructional package or seen as an unnecessary add-on? The courses offered by BM and PSA were most prone to this pressure because they were more generalist in nature whereas EE and BC could use specialisation to argue for fewer service modules. A resource issue dominated the instructional design process and seems to have had long-lasting effects. More recently introduced courses (AP and LW), in a much bigger institution, were not as prone to the resource pressures outlined above and have had the opportunities to learn from the problems observed with courses introduced earlier.

To some extent, course designers have been able to restrict the number of modules and also insist on more tailoring and integration of service modules. Nevertheless, being the first cohort to be taught still brings with it the pressures of accountability as the first graduates emerge, particularly as the progess of each course is externally reviewed.

Taken altogether, all of the courses under examination have been offered in circumstances where special pressures seem to apply due either to the newness of the Institution and the newness of the courses. What remains to be seen is whether the trends observed continue with the next cohort under observation and whether expansion plans underway have a further effect on the way students at CPHK undertake their study.

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STUDY OF STUDENT COSTS USING ACTIVITY BASED COSTING METHODOLOGY

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Restructuring of the higher education system coupled with a review of the principles and mechanisms of resource allocation have been two major, new directions of higher education in Australia. This paper explores the second of these initiatives and reports on a study of part-time student costs carried out for the University of Technology, Sydney by the consultants Ernst & Young, using activity based costing methodology. The study concluded that a Relative Funding Model adopted by the Australian Government for determining Commonwealth operating grants for universities in the 1991-93 triennium, which is based on student workload, discipline costs and course level is basically flawed. A more appropriate funding model would recognise fixed administrative and faculty costs and variable faculty costs.

A policy discussion paper (Green Paper) on Future Directions of Higher Education in Australia, was released by the Federal Minister for Education, Employment and Training, The Hon. John Dawkins, M.P., in December 1987.[1] The thrust of the Green Paper was for higher education to have a central role in solving Australia's economic problems. A major goal was also to achieve growth of higher education in a climate of continuing financial restraint.

There were a number of outcomes from the subsequent Commonwealth Policy Statement on Higher Education (White Paper) circulated by the Minister in July 1988, the principal outcome being the development of a Unified National System (UNS) of higher education in Australia in place of the former binary system of Universities and Colleges of Advanced Education.[2]

By early 1991, the UNS of higher education, as envisaged by Minister Dawkins, was all but in place. All states of Australia, with the exception of Victoria had finalised their restructuring of higher education through the amalgamation or networking of colleges with established universities. The binary system, developed in the mid 1960's to cope with the growing demands for higher education, and the abolition of fees in the mid 1970s to improve access to higher education, were Commonwealth Government policy initiatives that were reversed by the Hawke Government in 1990. The objectives of the UNS are the same - to achieve greater efficiency and effectiveness in higher education in meeting national, priority goals, of providing greater access for students and significant growth in enrolments - but the political strategies have been changed.[3]

A second major outcome of the Government Green and White Papers was a review of the principles and mechanisms for resource allocation. In particular, the Government was concerned

> "...to ensure that institutions are able to participate equally in the Unified National System, to provide an equitable basis on which institutions could compete for funds, (and)... to remove the funding inequities that have arisen over time and are still reflected in current funding allocations."[4]

Whereas Commonwealth funding, which currently represents in excess of 80% of most institution income, was previously on an annual basis, a rolling triennial process was introduced from 1989 for the 1990/92 triennium to enable institutions to plan for future growth. Institutions were required to negotiate annually with the Commonwealth their growth proposals and educational profile for the following triennium.

Another major resource initiative was the introduction from 1991 of a Relative Funding Model (RFM) for higher education. This was aimed at meeting the Government's commitment in the Green and White Papers to fund institutions of higher education on the basis of what they do rather than historical precedent and arbitrary classification. The Government recognised

> "that significant distortions existed in the base allocation of Commonwealth higher education operating grants and undertook to develop an approach which would provide a more equitable distribution of base funding."[5]

Following the commissioning of three studies of relative teaching costs and consultation with universities on the principles and framework for the model, the Commonwealth Department of Education, Employment and Training (DEET) developed the RFM based on a two dimensional matrix, using discipline cost as one axis and course level as the other. A limited number of teaching cost categories (or clusters) were selected in order to keep the model simple (5 clusters were selected at undergraduate and 2 at postgraduate level) and 3 course levels were adopted - undergraduate, other postgraduate, and research degree. The relative weightings of each cell in the matrix were established from the findings of the three teaching cost studies. Details of the model are shown below.

RELATIVE FUNDING MODEL: CLUSTERING OF DISCIPLINES [6]

Cluster	Undergraduate	Other Postgraduate	Research Degree
1	Accounting Admin/Economics Law Other Humanities	Accounting Admin/Economics Law Other Humanities Education	Accounting Admin/Economics Computing Education Law
2	Behavioural Science Education Maths/Stats Other Social Stud.	Maths/Stats Other Social Stud.	Maths/Stats Nursing Other Build Env. Other Health Other Humanities
3	Computing Nursing Other Built Env. Other Health Other Languages Visual/Perf. Arts	Computing Nursing Other Built Env. Other Health Other Languages Visual/Perf. Arts	Other Languages Other Social Stud Visual/Perf.Arts
4	Engineering Science Surveying	Agriculture Behavioural Sci. Dentistry Engineering	Agriculture Behavioural Sci. Dentistry Engineering
5	Agriculture Dentistry Medicine Vet Science	Medicine Science Surveying Vet Science	Medicine Science Surveying Vet Science

RELATIVE FUNDING MODEL: RELATIVE TEACHING COSTS MATRIX [7]

Cluster	Discipline Weights		
	Undergraduate	Other Postgraduate	Research Degree
1	1.0	1.4	2.0
2	1.3		
3	1.6	1.8	
4	2.2	3.0	4.7
5	2.7		

Operating grants for the 1991-93 triennium were calculated by summing the institution's teaching load (which, in Australia, is expressed in Equivalent Full-Time Student Units - EFTSU's) in each cell of the matrix after multiplying the load in each cell by the relative weighting factor. DEET has advised institutions that the formula would be used on a once only basis, for determining 1991-93 operating grants and thereafter would determine grants on an historical basis.

With the exception of special funding for students on industrial experience, given a weighting of 0.2 EFTSU, the model does not attempt to cover institution-specific cost factors, such as, remoteness of campus, smallness of scale, etc. Furthermore, the RFM provides for a discretionary element to be allocated to institutions on an annual basis. In publishing the RFM the Government noted that the weightings were consistent with the bands established for funding purposes by the UK Department of Education and Science and the New Zealand Ministry of Education.[8]

During the development of the model there were several steps taken to consult with institutions and to seek feedback on critical attributes of the model. In November 1989, at an early stage in the development of the model, there were many suggestions presented at a seminar held in Canberra, including comments that the development of the model should be open and objective, the model should be simple, and should contain real costs rather than ideal inputs. In relation to this latter comment it was stated:

> *The model should relate directly to current patterns of institutional expenditure rather than costs based on ideal inputs, and differentiate reliably between institutions with different educational profiles.*[9]

In this context, some Vice-Chancellors argued that the costs of administering part-time students and the industrial component of co-operative education or sandwich courses should be fully recognised. Subsequently, a special loading was acknowledged for administering the industrial component of co-operative eduction courses but hard data was sought on the cost of administering part-time students. This paper reports on a study undertaken for the University of Technology, Sydney (UTS) by the consultants, Ernst and Young on the cost of part-time study. UTS is the largest national provider of part-time education, with almost 9,000 students enrolled under this mode in 1990 (46% of total enrolments), although all thirty-six public institutions of higher education in Australia reported a proportion of their total students enrolled in part-time study in 1990. The study focused on part-time, internal students not external or continuing education students.

Whereas part-time students were for many years counted by the Commonwealth Government as equivalent to half a full-time student and this served also as the basis for funding institutions, in 1982 the Government adopted EFTSU as a student load measure and counted part-time students as students undertaking 0.75 or less of a full-time student load. As the principal basis for determining institutional operating grants has been reported student load, the claim of institutions committed to part-time education has been that, for most if not all, administrative and support activities, a part-time student incurs at least the same administrative load and cost as a full-time student, not one-half or three-quarters of the load and cost.

Setting aside the educational and social merits of part-time study, there have been few attempts to determine the relative institutional costs of this alternative mode of study, either in Australia or overseas. Also the findings have been equivocal and some studies have looked beyond institutional costs to the human and social costs of part-time study and the need for financial support for part-time students.[10]

The methodology adopted for these previous studies has focused on determining marginal costs where estimations and the attribution of overheads represent significant complexities. But, apart from these difficulties, there is evidence to suggest that part-time students are not accorded the same attention or service by some institutions as full time students, and financial constraints on institutions limit the extent to which part-time students can be served.[11] Thus it is not surprising that some studies have suggested that the institutional cost of part-time is lower than full-time education.[12]

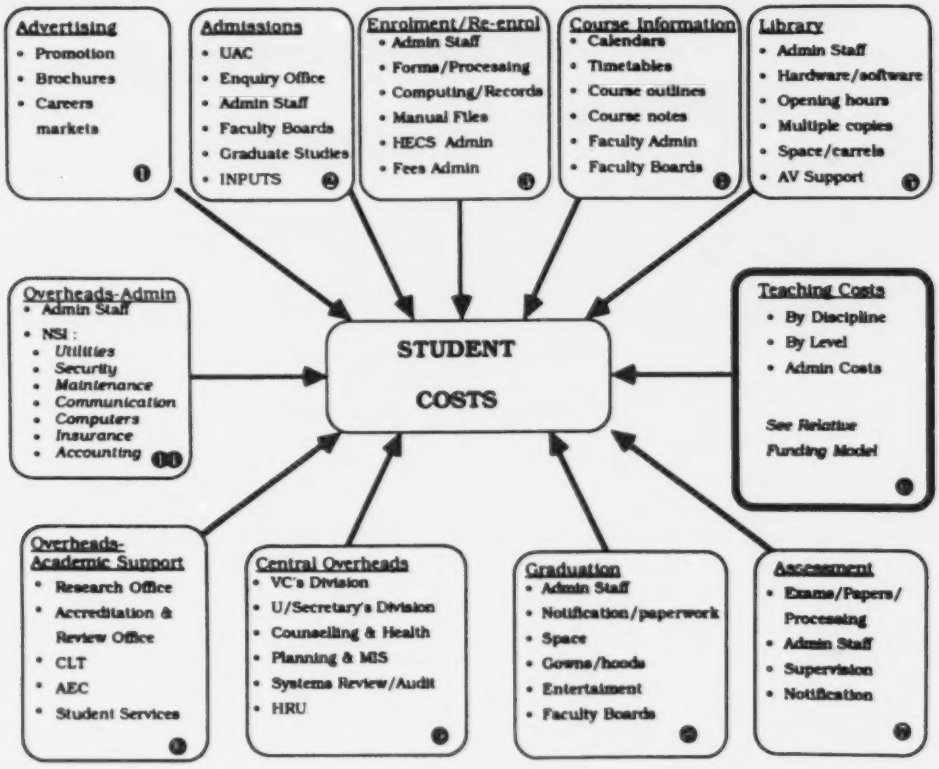
While research in the 1970's provided clear evidence of increasing numbers of adults who are continuing their education on a part-time basis, one of the impacts of global recession since the late 1980's has been to improve retention rates both at high school and at University, particularly of full-time students.[13] However, it seems that part-time students in present times are more likely to be concerned to retain their employment at the expense of continuing part-time classes.

So, the part-time student may not only suffer some social and opportunity cost of foregone leisure time but appears to be discriminated against by some institutions in terms of services, and may be pressured by employers in times of economic difficulty. If, on top of these factors, the cost of providing services and support to part-time students is only partially funded, and retention of full-time students remains high, there are significant reasons for discontinuing this alternative mode of study. For an institution like UTS, committed to supporting part-time students, the motivation to have an independent study of part-time student costs, using a recognised costing methodology was high.

In October 1990, UTS invited expressions of interest and tenders for the conduct of a study of part-time student costs. Three major accounting firms were approached and each submitted proposals based on the modern, activity based costing (ABC) methodology developed by Kaplan at Harvard University.[14]

Each had previous experience in its application and the tendered price for the study varied marginally between all three firms. The preferred proposal from Ernst and Young was favoured for their proposal to establish a residual framework to enable UTS to continuously monitor the cost effectiveness of its teaching and support activities. As part of the preliminary briefing of the three firms, the UTS organisation structure, details of the university budget for 1990, as well as an annual report were provided to each firm. In addition, the following life cycle of activities associated with the process of a student through the university was provided.[15]

Life Cycle of Institutional Activities Contributing to Student Costs



As Ernst & Young explained, ABC was chosen as the most appropriate approach to the study for the following reasons:

"1. Activity Based Costing concentrates on the identification and allocation of costs to the activities undertaken by an organisation. This technique allows greater management insight into the reasons for cost behaviour, as compared to the more traditional classification of costs by departments and cost centres. Many activities cut across functional departmental boundaries and are thus hidden in many traditional accounting classification systems.

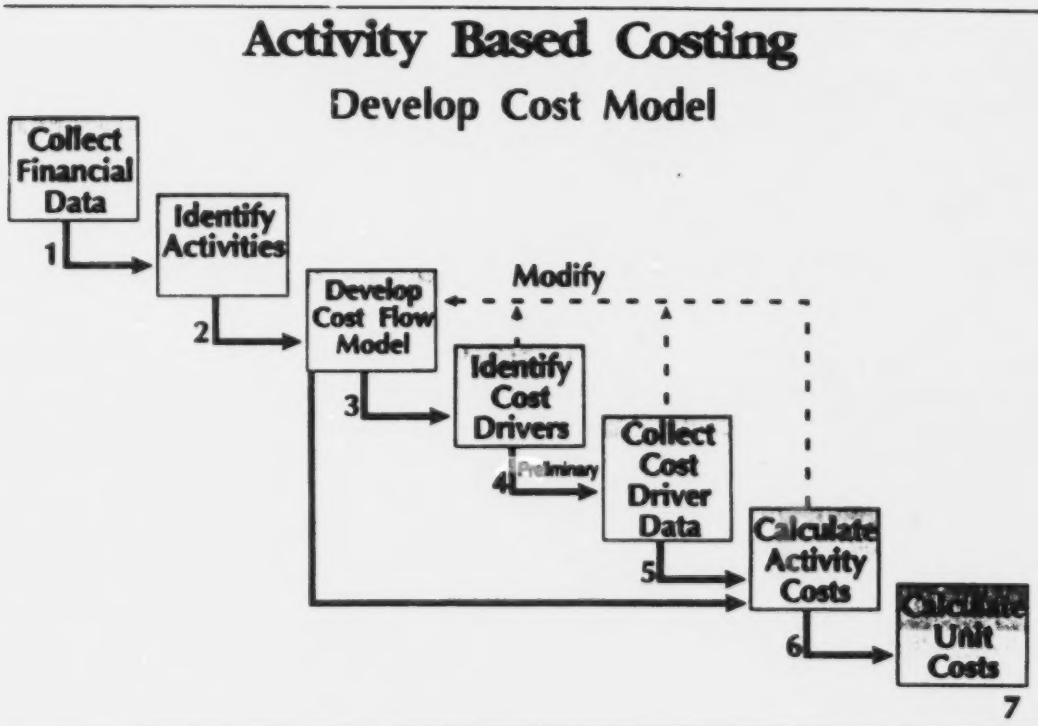
Activity Based Costing has been developed so as to eliminate the necessity for the arbitrary nature of cost allocation and apportionment that is a prevalent feature of many orthodox cost accounting systems.

2. Activity Based Costing seeks to determine the event that gives rise to the activity and hence cost to be incurred. This event under the Activity Based Costing methodology is called the Cost Driver. Cost drivers therefore become the link between activities and the consumption of resources by the final product or service. Cost drivers allow management to understand why activities take place and resultant costs are incurred, which facilitates the process of cost control and planning.

3. Activity Based Costing depends on the establishment of a bill of activity for the product or service produced. This bill of activity can only be completed once the processes, sub-processes and activities undertaken within an organisation are understood and documented. The cost per unit of the driver that has been determined for each activity is used as the link between costed activity pools and unit service or product costs.

4. Activity Based Costing provides management with a new approach to the issues of cost planning and control. Rather than managing the dollar expenditures that result from management policy and actions or operational procedures and transactions, Activity Based Costing allows management to manage the driver. This approach enables management to effect long term changes to cost behaviours and is a vital tool in the establishment of operational budgets using a bottom-up approach."[16]

The approach adopted by Ernst and Young was based on the following ABC model. [17]



The assignment methodology involved six stages :

1. Interview program to determine activities
2. Accounts analysis and creation of cost pools
3. Establishment of cost drivers
4. Survey of faculty costs
5. Development of ABC model
6. Analysis of student costs

1. Interview Program

The initial phase in the study involved a program of interviews with administrative and support department managers and deans of all faculties to obtain a detailed knowledge of the activities of each department and faculty and an understanding of what drives the cost of each activity. The life cycle of activities provided at the commencement of the study gave an insight into UTS activities and provided a framework for the interview program. The interview program also enabled the study team to seek the opinion of deans and managers regarding the effect on costs of individual activities of part-time versus full-time students.

2. Accounts Analysis and Creation of Cost Pools

After the activities of the support departments had been identified, the accounts were reviewed to determine the extent to which these activities are identified in the UTS Chart of Accounts. Where activities were reflected in the accounting system, cost pools could be clearly determined by reference to the corresponding department in the account. Where the activities were not reflected in the Chart of Accounts it became necessary to create cost pools. Where some organisational units were involved in several distinct activities, but all financial information was combined under the one unit, eg, Student Administration Unit, it was necessary to breakdown these units into their constituent activities based on a staff activities analysis. In the final analysis, it was crucial to the validity of the study that all operating expenditure of UTS was recognised.

3. Establishment of Cost Drivers

Under the ABC methodology, once the activities undertaken by an organisation are established, it is necessary to determine the events that give rise to, or 'drive' the activity. This event is termed the cost driver. In some instances it is necessary to develop a two stage basis of cost allocation using primary and secondary drivers. Secondary drivers are those events which give rise to activities being undertaken that are directly attributable to the product or service being supplied. Primary drivers are those not directly attributable to the product or the service being supplied. It is necessary to ensure that non-financial data collected regarding cost driver volumes is related to the level of activity as reflected in the financial data. Where hard numerical data is not available, management estimates, or information from surveys, or data from group consensus may be required.

Following the interviews with departmental heads, cost drivers were determined in order to allocate costs of support departments to faculties. The pattern of resource consumption for each activity was analysed and possible cost drivers were evaluated. The final choice of cost drivers depended upon the availability of reliable information. An example of the cost drivers used in the study is shown in the following table.[18]

ACTIVITIES	PRIMARY COST DRIVER	PRIMARY ALLOCATION	SECONDARY COST DRIVER	SECONDARY ALLOCATION	COMMENTS
SECURITY	FLOOR SPACE	FACS & DEPT	# OF STUDENTS	STUDENTS	
COMMUNICATIONS	# OF STAFF FTE	FACS & DEPT	% TIME ACADEMIC STAFF	STUDENTS	
INSURANCE	TECH ESTIMATE	FACS & DEPT	# OF STUDENTS	STUDENTS	
CLEANING	FLOOR SPACE	FACS & DEPT	# OF STUDENTS	STUDENTS	
HEATING & LIGHTING	FLOOR SPACE	FACS & DEPT	# OF STUDENTS	STUDENTS	
RATES AND RENT	ACTUAL	FACS & DEPT	# OF STUDENTS	STUDENTS	
ESTATES	FLOOR SPACE	FACS & DEPT	# OF STUDENTS	STUDENTS	
FINANCIAL SERVICES	% OF TOTAL BUDGET	FACULTIES	# OF STUDENTS	STUDENTS	

4. Survey of Faculty Costs

The preceding phase details the process used to allocate the cost of support activities to students, which amount to approximately 35% of the total University costs. The remaining 65% is accounted for by faculty costs, which include faculty part-time academic salaries, full-time academic salaries, faculty support staff salaries, and non salary costs. Research grants were also treated as faculty costs although the accounting system treats them as a centralised expenditure. With such a large proportion of University expenditure occurring within the faculties, it was crucial to review these costs and determine a means of allocating them to the student categories (full-time, part-time, undergraduate and postgraduate students). One of the difficulties the consultants experienced in costing university education was related to the diversity of activities undertaken by academic staff. Whilst part-time academic staff are paid only for direct lecturing hours, permanent academics only lecture for approximately 30% of their working time. To establish a basis for determining faculty costs, a faculty activity survey was developed and its results used as a critical component in the study.

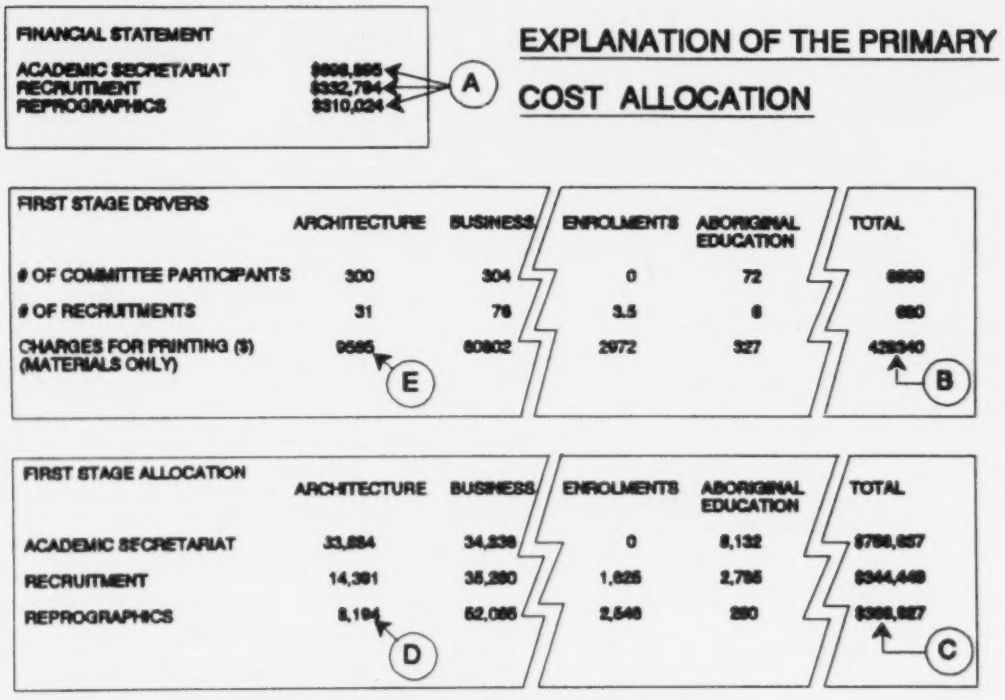
5. Development of ABC Model for UTS

An ABC model was developed on the Lotus 123 spreadsheet package, with five interrelating segments:

Segment 1 holds all primary financial data although some manipulations of information in the UTS general ledger were required.

Segment 2 incorporates the primary cost drivers arrayed against the activities.

Segment 3 incorporates the primary cost allocations; five allocation phases were necessary, utilities being allocated initially and further phases to account for the cross servicing between departments. The following figure provides an illustration of this allocation process.[19]

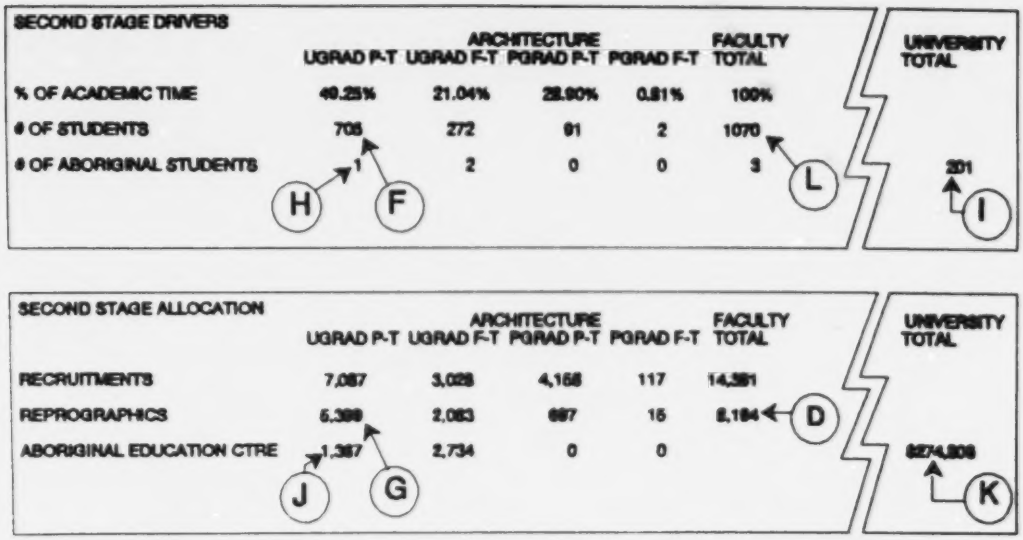


NOTES.
1. The figures in the Financial Statements (A.) are obtained from the General Ledgers.
2. B. is the total of charges made for reprographics during the year.
3. E. is the total charge made by the reprographics unit to the Architecture and Building faculty.
4. C. is composed of the figure in the Financial Statements plus the allocations of other overheads made earlier in the allocation process. e.g. Insurance, Cleaning etc.
5. D. is calculated by dividing the total cost of the reprographics activity (C.) by the total printing drivers (B.) and multiplying by the printing drivers for Architecture and Building (E.). I.e. $366,927 / 429,340 x 9685= 8194.

Segment 4 includes secondary drivers to the four student cost categories.

Segment 5 is where the secondary allocation (to students) is undertaken. The individual costs allocated to faculties in segment 3 are transferred to the faculty total column and then allocated into the four student categories on the basis of the cost drivers in Segment 4. Segment 5 also includes those costs allocated to students not included in Segment 3 and had therefore not previously been allocated to faculties. The following figure illustrates this secondary allocation process.[20]

EXPLANATION OF THE SECONDARY COST ALLOCATION



NOTES
1. The figure at D. (the reprographics allocation to Architecture and Building) has been directly transferred from the primary cost allocation.
2. The allocation of the reprographics charge to the four categories of students is undertaken using the "# of students" driver. The allocation to part time undergraduates (G.) is calculated by dividing the total faculty cost (D.) by the total number of students in the faculty (L.) and multiplying by the number of undergraduate part time Architecture and Building students (F.).
3. The allocation of the Aboriginal Education Centre costs is undertaken entirely in the secondary cost allocation stage. The allocation to undergraduate part time students (J.) is achieved by dividing the total cost of the Aboriginal Education Centre (K.) by the total number of Aboriginal students at the University (I.) and multiplying by the number of undergraduate part time Aboriginal students in the Architecture and Building faculty (H.).

6. Analysis of Student Costs

The following table summarises the total of student costs per EFTSU.[21]

STUDENT COSTS : TOTAL STUDENT COSTS PER EFTSU

	UNDERGRADUATE		POSTGRADUATE	
	Part-Time	Full-Time	Part-Time	Full-Time
Average Faculty Costs	6,076	4,398	7,180	8,043
Average Admin. Costs	3,501	2,235	4,264	2,929
Total	9,577	6,633	11,444	10,972

The results of the financial model revealed:

1. Only small variations in central administration or support costs between part-time and full-time students.

2. The vast majority of central administration costs which reflect centralised overheads and support activities, are dependent on actual student numbers as apposed to EFTSU's; the only exceptions are library costs and computing costs which are affected by student workload.

3. A number of support activities within faculties are dependent upon student numbers and are unrelated to student workload, eg. course development and administration.

4. As a university average, the total cost of part-time undergraduate students when viewed in terms of cost per EFTSU is 44% higher than full-time undergraduate students.

The broad conclusions from the study were:

1. Student cost is not proportional to a student's workload (or EFTSU);

2. The cost of a student includes a fixed element and a variable cost element which is dependent upon the student's workload (or EFTSU);

3. A method of funding based entirely on EFTSU's is not a reflection of the level of expenditure required to support a diverse student population, and

4. UTS, with a large part-time student population, is under funded through the Commonwealth Government Relative Funding Model which fails to address the fixed element of administration costs.[21]

A more appropriate funding model would recognise the following costs in a student profile:

- a set administration cost;
- a set faculty cost;
- a variable faculty cost.

This could be represented in the fashion of the following formula:

- funding = a x (student #'s) + b x (EFTSU)

  where:

  a = the fixed cost per student for the faculty
  b = the variable cost per student for the faculty

Clearly the fixed amount per student would vary between disciplines as would the coefficient of the variable amount.

As the study of part-time student costs at UTS was the first reported application of activity based costing methodology in higher education it is worthwhile reflecting on some of the limitations and difficulties experienced in the application.

1. Some of the organisational units such as Student Administration and Publicity and Public Affairs were responsible for several activities and it was necessary to carry out a detailed analysis of staffing and expenditure to separate out the costs of individual activities. Sometimes staff performed more than one activity as part of their job and it was necessary to estimate the amount of time spent on individual activities. This task was time consuming.

2. In the case of some cost drivers data was not readily available, for example in relation to space which was a driver for a number of overheads, such as cleaning, power, security. In these cases it was necessary to make technical estimates as a basis for allocating costs. Appropriate cost driver information was also not available for the library or for computing and technical estimates were necessary in these areas.

3. Another difficulty arose from the fact that in the first year of amalgamation the organisational structure for a number of administrative areas had not been finalised and there was some duplication of costs between old UTS and Kuring-gai.

4. In a broader application of the methodology, particularly for comparative purposes, it would be necessary to recognise a potential problem may arise from individual differences between one university and another in the treatment of certain administrative activities. For example, at UTS, careers and appointments activities are carried out by the Union, whereas at many universities these costs are met by the university administration.

Many of these points highlight not so much limitations of the methodology, but some complexities in its application, particularly as a result of the way in which universities are structured and financial information is recorded. Despite the added complexity of the application of the methodology at UTS in its first year of amalgamation, it should be noted that the study was completed by Ernst & Young in just over three months.

The UTS study in 1990 should probably be treated as a pilot application of the ABC methodology in higher education. Two further initiatives which might be explored would be a study using the methodology in a multiple university setting, and a more detailed microstudy of certain key activities in university administration, such as University admissions.

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Title: A SURVEY OF ENVIRONMENTAL SCANNING IN U.S. TECHNICAL AND COMMUNITY COLLEGES

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ABSTRACT

Environmental scanning has become an increasingly important tool utilised to assist in the planning function of educational institutions. This paper describes the results of a survey of community and technical colleges in the U.S. to determine the extent of environmental scanning practises. The survey was designed to identify those institutions that are currently practising environmental scanning; the linkage of environmental scanning to program development, evaluation, budgeting functions, and strategic planning; personnel involved; and, institutions that could serve as resources to other colleges developing or expanding their scanning capabilities. The survey was conducted in the spring of 1991 and involved the 991 member institutions of the American Association of Community and Junior Colleges (AACJC).

INTRODUCTION

Technical and community colleges in the United States exist in a complex and turbulent environment. The nation is focused on educational accountability, and demands that graduates have the knowledge and skills to move the nation into the twenty-first century. Meanwhile, community colleges face growing enrolments of diverse students--students from varied cultures and personal family situations. Rapid, complex changes in the economy, the workplace, political systems, values, and lifestyles profoundly affect community colleges; many are ill-prepared to respond effectively.

Jeffrey Hallett describes this period as the "PresentFuture": a time of rapid and profound change when the need to respond to the challenges of the future exist in the present. It is crucial that institutions have the capability to analyze these environmental changes and the future in order to develop responsive institutional policies and practises.

Institutional recognition of environmental impact occurs when a process of external scanning and forecasting becomes a central feature of the institutional planning effort. When scanning is put into practise, an organisation can envision its future, define options, and "get out in front" of anticipated environmental changes. Environmental scanning and forecasting is a critical component of successful corporate and non-profit organizational planning. Environmental scanning provides the impetus for decisive action, often giving the organisation a competitive advantage.

Brown and Weiner (1985) described environmental scanning as "a kind of radar to scan the world systematically and signify the new, the unexpected, the major and the minor." Joe Coates (1985) identified the objectives of an environmental scanning system as:

1. To detect scientific, technical, social, and political interactions and other elements important to the institution.
2. To define potential threats, opportunities or changes for the institution by those interactions and elements.
3. To promote a future orientation and management in the institution's leadership.
4. To alert the administration and staff to trends that are converging, diverging, interacting, accelerating, or slowing.

S. C. Jain (1984) has identified four phases in the evolution of environmental scanning in corporations:

1. Primitive Phase--the institution faces the environment as it appears and has exposure to information without purpose and effort; scanning is without impetus.

2. Ad Hoc Phase--the institution watches out for likely impact of the environment on the institution; there is no active search, but the institution is sensitive to information on specific issues; it may scan to enhance understanding of a specific event.

3. Reactive Phase--the institution deals with the environment to protect its future; scanning is an unstructured and random effort with no specific information collected; scanning is done to make appropriate responses to competition and/or markets.

4. Proactive Phase--the institution forecasts the environment for the desired future; scanning is a structured and deliberate effort to collect specific information using established methodology for analysis. Scanning is done to enable the institution to be on the lookout for its competitive advantage.

Jain describes the sophistication of scanning efforts in terms of the following four variables:

1. The usual method of scanning: Ad hoc studies only, periodically updated studies, or structured system of data collection and processing.
2. The usual motivation for environmental scanning: crisis initiated, decision and issue oriented, or planning process oriented.
3. The usual data included in the scan: retrospective, current, or prospective.
4. The time frame for usage of scanning information: immediate, near-term (one to five years), or long-term future (more than five years).

The most sophisticated models utilise a structured system of data collection and processing, are planning process oriented, include prospective data, and are utilised in long-term planning.

Definition of Environmental Scanning

For the purpose of this study, environmental scanning is defined as the systematic collection and monitoring of information describing changes in the environment in order to identify and assess emerging developments, trends, and precursor events that may affect the strategic and tactical objectives of an organisation.

Purpose of the Study

The purpose of this survey was to determine the extent of environmental scanning practises in community, technical, and junior colleges in the United States. This survey was designed to identify those institutions that are currently practising environmental scanning, the characteristics of these colleges, the linkage of environmental scanning to planning and decision making, personnel involved, the sources, method, and products of the scanning activities, and institutions that could serve as resources to other colleges developing or expanding their scanning capabilities.

Preliminary Assessment

An initial assessment was conducted in August of 1990 through a survey of state offices for community colleges. This survey attempted to identify community, technical, and junior colleges performing environmental scanning. A list of the state offices and the name of a contact person at each office was obtained from the American Association of Community and Junior Colleges (AACJC). The respondents were asked to provide the names of colleges in their state conducting environmental scanning. For those not responding to the written survey, telephone calls were made in order to obtain the data. The state offices identified a total of 32 technical and community colleges

conducting environmental scanning. The results indicated a lack of understanding regarding environmental scanning; for example, even though a definition of environmental scanning was given, several respondents provided the names of individuals working in the area of environmental health and safety.

Whereas the original intent of this assessment was to survey those institutions cited by their state offices as conducting environmental scanning, the researchers noted that the majority of institutions that have published articles, scans or documents on this subject were not cited. For this reason, the researchers proceeded with the survey of all member institutions of the AACJC. This report summarizes the results of the survey conducted of the AACJC members.

THE STUDY

Methodology

Target Population. The membership list of the AACJC consisted of 1,013 community, technical and junior colleges, and of university and state systems offices in the United States and its territories, as well as Canada, Central America, and Mexico. An analysis of the list was conducted to eliminate duplicate institutions, resulting in 991 colleges to be surveyed.

Data Collection, Tabulation and Analysis. The survey was mailed on January 16, 1991, to the 991 member institutions of the AACJC. A cover letter and return envelope accompanied the survey; the survey was directed to the chief executive officer for each college or district, and was signed by John T. Blong, Chancellor of the Eastern Iowa Community College District (EICCD). A second copy of the survey was mailed on February 19, 1991, to those who did not respond before the stated deadline. A total of 612 (62%) surveys were returned; of these 601 were considered valid for the survey. Two hundred forty-eight (41% of the valid returns) indicated that their college conducts environmental scanning. All surveys were tabulated and analyzed using the Statistical Package for the Social Sciences (SPSS).

Survey Design

The survey consisted of 27 questions; the first 4 were to be completed by all respondents and requested information regarding the organisational structure and credit enrolment of the responding institution, the institution's current interaction with its external environment, and whether the institution currently conducts environmental scanning as defined on the survey. These questions regarding institutional characteristics were included to ascertain if environmental scanning practises differ by type of organisational structure and size of enrolment.

The remaining 23 questions were to be answered only by those institutions that currently conduct environmental scanning. Institutions conducting environmental scanning were asked to select responses which describe:

- how scanning is conducted at the institution
- the motivation for scanning
- who is involved in scanning
- the sources that are scanned
- the type of data included in scan documents
- the interpretation, compilation, and reporting of scan information
- how long they have been scanning
- how scanning is coordinated
- how scanning and its products are utilised by the institution
- how scanning is linked to strategic planning, program development, and budget development

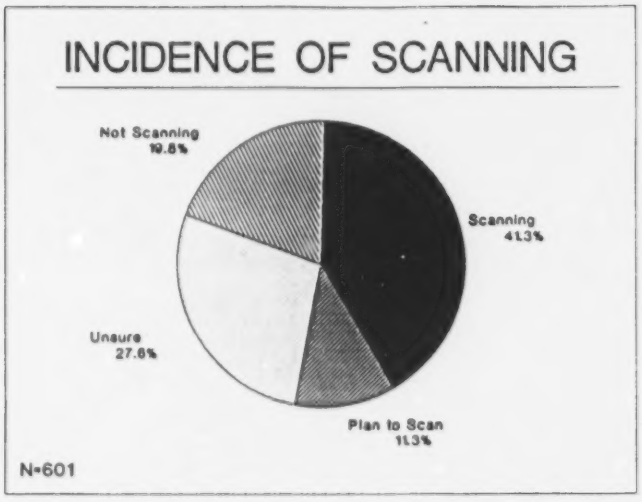
Several items were designed to determine the placement of the college's environmental scanning practises in relationship to Jain's four phases in the evolution of environmental scanning. These items dealt with the type of data in the environmental scan, and the time frame for decision making.

The respondents were also asked to describe the most successful and least successful aspects of environmental scanning and its use at their institution, and whether or not they would participate in a network of community, junior and technical colleges that are engaged in environmental scanning. A copy of the survey instrument is given in Appendix A.

SURVEY RESULTS

Survey Respondents. Six hundred twelve (62%) of the 991 members of the AACJC responded to the survey; of the 612 respondents, 601 were considered valid for the survey. Two hundred forty-eight (41.3% of the valid returns) indicated that they conduct environmental scanning as defined by the definition given above. Sixty-eight (11.3%) indicated that they plan to initiate environmental scanning within the next two years. These data are summarised in Figure 1.

FIGURE 1



Characteristics of Colleges Planning to Initiate Environmental Scanning within the Next Two Years. An analysis of the responses provided by the 68 colleges that expect to initiate environmental scanning within the next two years indicates that 60% are a single college with one principal site; 31% are a single college with multiple campuses; and, 6% are a multiple-college district. Forty-one percent had a Fall 1990 full-time equivalent credit enrolment of 500-1,999 students.

Colleges that Currently Conduct Environmental Scanning

College Characteristics

Of the 248 community colleges that currently conduct scanning, 51.6% are a single college with one principal site, 34.3% are a single college with multiple campuses, 7.7% are multiple-college districts, and 5.6% are a part of a university or a state system of community colleges.

The type of community college organizational structure representing the lowest percentage engaging in environmental scanning is the single college with one principal site. These data are summarised in Table 1.

Table 1
Percentage of Colleges That Scan by Organizational Structure

	Total	Number	Percent
Single College With One Principal Site	339	128	37.8
Single College With Multiple Campuses	184	85	46.2
Multiple-College District	42	19	45.2
Other*	33	14	42.4
No Response	3	2	66.7
	601	248	

* Other includes community colleges that are part of a university or state system.

Sixty-nine percent of the colleges that currently conduct environmental scanning had a Fall 1990 full-time equivalent credit enrolment of fewer than 4,999 students. As Table 2 indicates, the greater the credit enrolment, the more likely the institution will be engaged in environmental scanning ($X^2(4, N = 590) = 20.94, p < .001$).

Table 2
Percentages of Community Colleges that Conduct Scanning by Fall 1990 Full-Time Equivalent Credit Enrollment

	Total	Number	Percent
0-499	36	8	22.2
500-1999	247	85	34.4
2000-4999	176	78	44.3
5000-9999	84	43	51.2
10,000 or more	50	29	58.0
No response	8	5	62.5
	601	248	

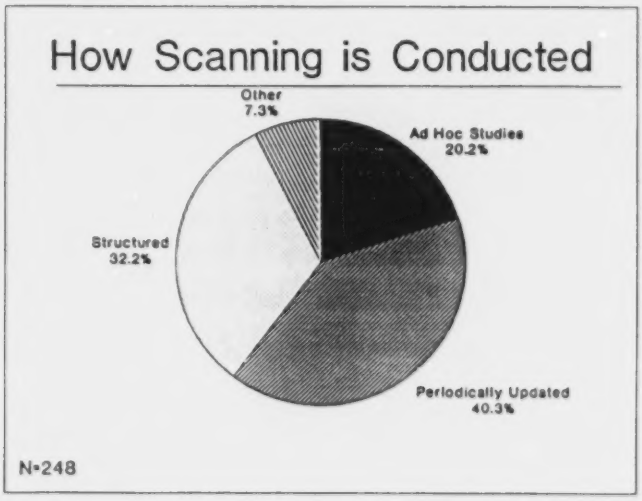
Sophistication of Scanning Efforts

For the purpose of this study, sophistication of scanning efforts is described in terms of the four variables identified by Jain. These are:

1. The usual method of scanning.
2. The usual motivation for environmental scanning.
3. The usual data included in the scan.
4. The time frame for usage of scanning information.

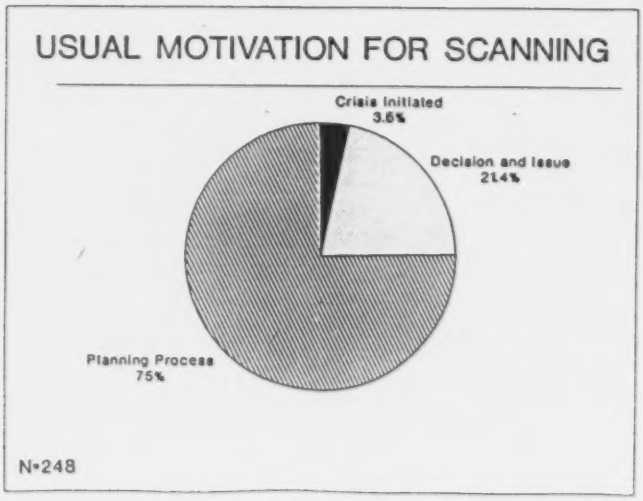
Scanning Method. Scanning at 40.3% of the institutions can best be described as periodically updated studies; 32.2% utilise structured data collection and processing systems; and, 20.2% conduct ad hoc studies only. These data are illustrated in Figure 2.

FIGURE 2



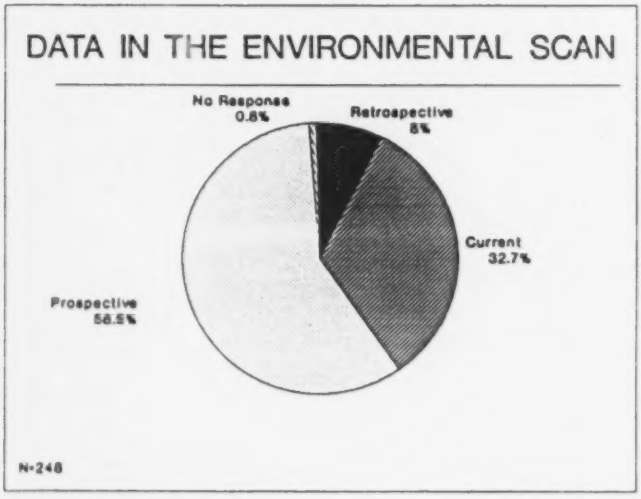
Motivation For Scanning Activities. Only 3.6% of the colleges indicated that their motivation for conducting scanning activities is crisis-initiated; 21.4% are decision- and issue-oriented, while 75% are planning process oriented. These data are illustrated in Figure 3.

FIGURE 3



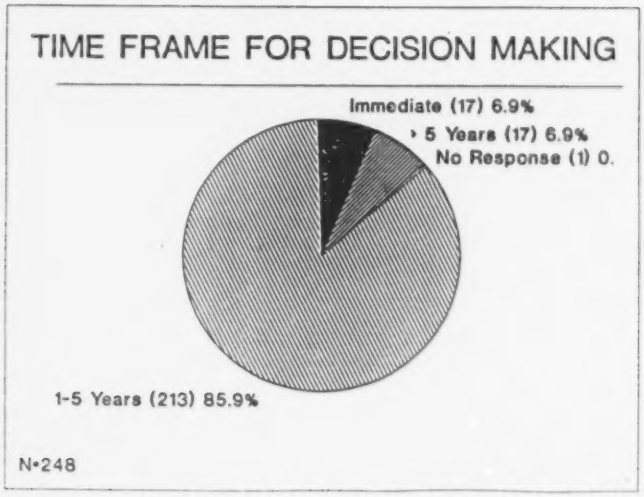
Type of Data in the Environmental Scan. Only 8% of the colleges indicated that the data included in their environmental scan are retrospective, i.e., used as a means to assess what has been done. For 32.7% of the respondents, environmental scanning consists principally of data for immediate use; 58.5% emphasize prospective data for forecasting the future. These data are summarised in Figure 4.

FIGURE 4



Time Frame for Decision Making. The vast majority of the respondents (85.9%) indicated that the environmental scanning information is used primarily to guide decisions in the near-term (1- to 5-year time frame). Only about 7% utilise the information to guide decisions beyond five years, while an equal number utilise it for making immediate decisions. These data are summarised in Figure 5.

FIGURE 5



Sophistication of Scanning College Composites. A composite for each college was developed to determine its relative placement in sophistication of scanning efforts by assigning values ranging from one to three for each of the four sophistication variables. These values are illustrated in the matrix given in Figure 6.

FIGURE 6

	Value		
Variable	1	2	3
Usual Method	Ad hoc Studies Only	Periodically Updated Studies	Structured System of Data Collection
Motivation for Scanning	Crisis-initiated	Decision and Issue Oriented	Planning Process Oriented
Data in Scan	Retrospective (past)	Current	Prospective
Time frame for Use of Scan Info.	Immediate	Near-term (1-5 years)	Long-term (>5 years)

Composite scores range from four to 12, with a mean of 9.21 and a median of 10. As Table 3 indicates, only eight (3.2%) of the respondents scored a maximum of 12; i.e., they utilise a structured system of data collection, their motivation for scanning is process-oriented, data in the scan are prospective, and the time frame for use of the scan information is long-term. The low number of institutions scoring maximum 12 points is because of the low number that utilise scanning information to guide decisions beyond five years. Forty-nine (19.8%) of the respondents scored 11. These data are detailed in Table 3.

Table 3
College Composites by Sophistication Variables

Points	Number	Percentage
4	4	1.6
5	5	2.0
6	11	4.4
7	21	8.5
8	25	10.1
9	52	21.0
10	70	28.2
11	49	19.8
12	8	3.2
	3	1.2
	248	100.0

Beginning Date for Environmental Scanning. Fifty percent of the colleges have been conducting scanning activities for five years or less. The peak period for initiation of these activities was 1986-88. These data are summarised in Table 4.

Table 4
Beginning Date for Environmental Scanning

Number of Years Conducting Scanning	Year Started	Number	Percent
Less than 1 year	1991	2	0.8
1 - 5	1986-90	122	49.2
6 - 10	1981-85	61	24.6
11 - 15	1976-80	24	9.7
16 - 20	1971-75	6	2.4
21 - 25	1976-70	7	2.8
26 or More	1966	2	0.8
No Response		24	9.7
		248	100.0

It might be expected that the longer an institution has been conducting environmental scanning, the more sophisticated its environmental scanning systems. The only sophistication measure associated with the length of time scanning has been conducted is the usual method of scanning: those that conduct structured systematic data collection have been conducting scanning for an average of eight years (ranging from 1966 to 1989), while those that principally conduct periodically updated studies have been scanning for an average of five years (ranging from 1970 to 1991). ($F(2,193) = 4.59$, $p<.01$). Those primarily conducting ad hoc studies only have been doing so for an average of six years (ranging from 1970 to 1991).

The Scanning Process

Scanning Coordinator. As 59% of the respondents indicated, the most common position coordinating environmental scanning activities is the Vice President (Director or Dean) of Institutional Research and/or Planning. The second most common position is that of the Chief Executive Officer (18%).

Scanning Participants. As Table 5 indicates, 90% of the colleges that conduct environment scanning involve 20 or fewer people; 61.3% involve five or fewer people. Fifty-three (21.4%) of the respondents indicated that only one person conducts environmental scanning; in 32 of these cases, that individual reports directly to the Chief Executive Officer.

Table 5
Number of Individuals Involved in Environmental Scanning

	Number	Percent
1 Person	53	21.4
2-5 People	99	39.9
6-10 People	39	15.7
11-20 People	32	13.0
21-35 People	8	3.2
36-50 People	6	2.4
More than 50 People	9	3.6
No Response	2	0.8
TOTAL	248	100.0

Scanning participants represent a broad range of institutional employees. In 92.7% of the responding community colleges, administrators participate in environmental scanning activities; faculty are involved in scanning at 67.7% of the colleges, followed by professional/technical staff at 54.8%. These data are summarised in Table 6.

Table 6
Scanning Participants

	Number	Percent
Administrators	230	92.7
Faculty	168	67.7
Professional/Technical Staff	136	54.8
Classified Staff	110	44.4
Governing Board Members	76	30.6
Community Members	74	29.8
Students	65	26.2
Other	18	7.3
No Response	9	3.6

N=248; multiple responses to this item were allowed.

Scanning Sources. The most frequently utilised source for environmental scanning are systems reports, followed by state-wide data bases, labor market assessments, and professional literature. The least utilised sources are environmental monitoring publications and classified/help wanted ads in newspapers. These data are summarised in Table 7.

Table 7
Environmental Scan Sources

	Number	Percent
Systems Reports	225	91.5
State-wide data bases	216	87.8
Labor Market Assessments	212	86.2
Professional Literature	192	78.0
Popular Literature	131	53.3
Nation-wide data bases	121	49.2
Sectional Literature Targeted to a Specific Interest or Group	92	37.4
Futurist Literature	90	36.6
Other	58	23.6
Classified/Help Wanted Ads in Newspapers	55	22.4
Environmental Monitoring Publications	40	16.3

N=248; multiple responses to this item were allowed.

Other information sources listed by the respondents included local sources such as newspapers, service agency reports, planning and development group reports, school systems and city/county data bases; regional planning documents and reports; United Way's "What Lies Ahead"; internally developed surveys; census reports; university-generated data and data bases; consortia with local area colleges; state university research; and sources from attending national, regional, and state conferences and planning sessions.

Scanning Strategies. In addition to print and/or electronic information sources, the colleges utilise a variety of scanning strategies in their environmental scanning efforts. Seventy-five percent conduct locally developed surveys; 64.6% gather data from key informants; 47.1% conduct focus groups; and 42.9% report on informal conversations. A variety of other strategies are utilised by 9.2%, including information gathered through participation in conferences and community development meetings; input from program advisory committees; a formal "think tank" group at the college; and annual surveys conducted of employers and graduates.

"Other" strategies include participation in conferences and community development meetings; input from college and program advisory committees; a formal "think tank" group at the college; and annual surveys conducted of employers and graduates.

Environmental Scanning Model. Only 21 (8.5%) of the 248 colleges that conduct environmental scanning utilise a specific model; five of these are based on the ED QUEST model for strategic planning.

Interpretation, Compilation, and Reporting of Scan Information

Interpretation of Raw Data. The respondents were asked to indicate who interprets the raw data collected through environmental scanning for possible implications for the community college. Sixty-three percent indicated that administrators with expertise in the area were involved in such interpretation, while 53% indicated that the individual who collects the raw data interprets it. Forty-one percent utilise environmental scanning teams, while 33% involve relevant faculty.

Compilation of Information. As indicated by 66.3% of the respondents, the most common method of compiling scanning information is as a summary of implications. These data are summarised in Table 8.

Table 8
Compilation of Scanning Information

	Number	Percent
A Summary With Implications	161	66.3
A Composite of Several Similar Items	76	31.3
A Summary of Each Item or Article	71	29.2
A Written Scan and Forecast Without Implications	62	25.5
Other	18	7.4

N=248; multiple responses to this item were allowed.

"Other" methods of compiling the environmental scanning information is simply the clipping and sharing of articles; the printing and dissemination of fact sheets or occasional internal reports; the inclusion of an environmental impact section to an ongoing strategic plan; and the writing and dissemination of policy/position documents.

Who Compiles the Scanning Information. In the majority of colleges (58%), the individual who collects the scanning information is involved in compiling the report. Forty-nine percent indicated that administrators with expertise in the area are involved in compiling the scanning document, while 33% involved members of the environmental scanning teams. Faculty are involved in only 22% of the institutions.

Scan Products. The most common product resulting from environmental scanning activities are printed reports, followed by a data base. These data are summarised in Table 9.

Table 9
Environmental Scan Products

	Number	Percent
Formal Printed Reports	182	74.3
Data Base	83	33.9
Other	79	32.2
Newsletters	37	15.1

N=248; multiple responses to this item were allowed.

"Other" products include sections of various planning documents, internal work papers, "Futuring" sessions, sections in research briefs or fact books, reports to the Governing Board, memorandums, E-Mail messages, minutes of meetings, specific objectives added to the college plan, series of occasional reports, set of written scenarios, and oral reports to planning groups.

Frequency of Communicating Scan Information. How often scan information is communicated varies, with 3.2% of the respondents accomplishing it on a weekly basis and 37.1% on an annual basis. These data are summarised in Table 10.

Table 10
How Often Scan Information is Communicated

	Number	Percent
Weekly	8	3.2
Bi-Monthly	21	8.5
Semi-Annually	33	13.3
Annually	92	37.1
Other	92	37.1
No Response	2	0.8
	248	100.0

The majority of those who indicated "other" specified that the scanning information is communicated on an "as needed" basis, varying by topic and need. Several respondents indicated that the currency of information is of primary importance; one pointed out that in rare instances, the information may need to be communicated on a daily basis. Others indicated that specific information is needed for ongoing program review and evaluation processes, and are tied to a two-five year cycle. Others indicated that it is done periodically in the context of the planning process.

Uses of Environmental Scanning Information

The information gathered through environmental scanning is used for a variety of purposes by community colleges. It is used in institution-wide planning by 90.7% of the colleges; 80.6% of the colleges utilise the information for program planning and revision purposes, while it assists decision-making at all levels at 66.5% of the colleges. There is some linkage between environmental scanning and staff development efforts, as indicated by 38.7% of the respondents. The uses of scanning information by the respondents are summarised in Table 11.

Table 11
Uses of Scanning Information

	Number	Percent
For Discussion Only	44	17.7
To Develop Alternative Future Scenarios	115	46.4
Staff Development Efforts	96	38.7
Program Planning/Revision	200	80.6
Institution-Wide Planning	225	90.7
Decision Making at All Levels	165	66.5
Other	10	4.0

N=248; multiple responses to this item were allowed.

Who Uses Scan Information. The top management of the community colleges as well as the planning offices are the principal users of scanning information. At 89% of the colleges, the Chief Executive Officer utilizes scanning information, while 91.9% of the colleges reported its use by vice presidents (or equivalent). Seventy-three percent of the respondents indicated its use by the planning office, 69.1% by budget unit heads or other mid-level administrators, and 50.4% indicated use of the information by faculty. Fewer than half of the respondents indicated use of the information by their governing board. Data regarding who uses the scanning information are summarised in Table 12.

Table 12
Who Uses Scanning Information

	Number	Percent
Governing Board	120	48.8
Chief Executive Officer	219	89.0
Vice Presidents (or equivalent)	226	91.9
Budget Unit Heads or "Mid-Level" Administrators	170	69.1
Planning Office	180	73.2
Faculty	124	50.4
Students	29	11.8
Community Members	36	14.6

N=248; multiple responses to this item were allowed.

Linkages Between Environmental Scanning and Other College Processes. As indicated by 92.2% of the respondents, the most common link of environmental scanning with other college processes is to short-range planning (one to five years). At 82.4% of the colleges scanning is tied to program development; 72.1% have linked it to curriculum revision. Only 26.2% of the respondents have linked environmental scanning to performance evaluation. These data are summarised in Table 13.

Table 13
Linkages Between Environmental Scanning and Other College Processes

	Number	Percent
Links to Long-Range Planning (more than 5 years)	111	45.5
Links to Short-Range Planning (1 to 5 years)	225	92.2
Links to Program Development	201	82.4
Links to Curriculum Revision	176	72.1
Links to Budgeting	170	69.7
Links to Performance Evaluation	64	26.2
Links to Other	11	4.5

N=248; multiple responses to this item were allowed.

Most Successful Aspects of Environmental Scanning and its Uses.

The most successful aspects of environmental scanning at community, technical, and junior colleges, as indicated by the comments written on the surveys, are that it:

- facilitates better planning
- facilitates consensus-building
- brings college to the "cutting edge"
- involves many persons

Least Successful Aspects of Environmental Scanning and its Uses.

The least successful aspects of environmental scanning, as indicated by the comments written on the surveys, are:

- linking scanning to other college functions, i.e., program and curriculum development/revision, faculty/staff professional development, budgeting and resource allocation, and outside agencies.
- expanding the use of scanning information by college constituencies, faculty, middle managers, senior administrators, and institutional planners.
- mobilisation of institutional response to projected impact of future trends
- obtaining institutional support for environmental scanning activities

SUMMARY AND RECOMMENDATIONS

The results of this survey indicate a strong interest on the part of community, technical, and junior colleges in the United States to pursue environmental scanning as a means of keeping abreast of events and trends in the external environment that may impact the institution. Six hundred twelve (62%) of the 991 members of the AACJC responded to this survey; 248 (41.3%) indicated that they conduct environmental scanning, while 68 (11.3%) indicated that they plan to initiate environmental scanning within the next two years. A variety of scanning strategies are utilised by the colleges, but scanning is not an end in itself. Scanning provides information for decision-making and planning and is utilised principally by top college administration in institution-wide planning and program planning/revision efforts. The interest in pursuing and/or refining their institution's environmental scanning capabilities is evidenced by the 336 (55.9%) respondents indicating an interest to participate in a national environmental scanning/future planning network. It is recommended that a survey be conducted of these institutions to determine the functions that such a network could provide.

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APPENDIX A

CLINTON COMMUNITY COLLEGE
SCOTT COMMUNITY COLLEGE
MUSCATINE COMMUNITY COLLEGE

EASTERN IOWA COMMUNITY COLLEGE DISTRICT

DISTRICT OFFICE OF ACADEMIC AFFAIRS AND PLANNING
306 West River Drive • Davenport, Iowa 52801-1221 • (319) 322-5015

ENVIRONMENTAL SCANNING IN COMMUNITY COLLEGES

Environmental Scanning is the systematic collection and monitoring of information describing changes in the environment in order to identify and assess emerging developments, trends, and precursor events that may affect the strategic and tactical objectives of an organization. The purpose of this survey is to identify the environmental scanning activities conducted in community, junior, and technical colleges.

I

(1) 1. Which best describes the organizational structure of your college?
   1. A single college with one principal site
   2. A single college with multiple campuses
   3. A multiple college district
   4. Other (please specify) _____

(2) 2. What was the full time equivalent (FTE) credit enrollment of your college for Fall 1990?
   1. 0 - 499
   2. 500 - 1,999
   3. 2,000 - 4,999
   4. 5,000 - 9,999
   5. 10,000 or more

3. How would you describe your institution's current interaction with its external environment? (circle all that apply)
   (3) 1. We face the environment as it appears.
   (4) 2. We watch out for likely impact of the environment on the institution.
   (5) 3. We conduct no broad active search but are sensitive to information on specific issues.
   (6) 4. We conduct scanning to enhance our understanding of specific events.
   (7) 5. We conduct scanning to make appropriate responses to competition and/or markets.
   (8) 6. We conduct unstructured and/or random efforts with no specific information collection.
   (9) 7. We deal with the environment to protect our future.
   (10) 8. We conduct a structured and deliberate effort to collect specific information using established methodology for analysis.
   (11) 9. We conduct strategic scanning to be on the lookout for competitive advantage.
   (12) 10. We forecast the environment for a desired future.

(13) 4. Does your college conduct environmental scanning as defined in the box above? (circle one)
   1. Yes (proceed to Question 5)
   2. No ---------> If no, do you plan to initiate environmental scanning within the next two years?
      (14) 1. Yes
      2. No
      3. Unsure/don't know

You have completed the survey. Please return it in the envelope provided. Thank you for your cooperation.

© 1991, Eastern Iowa Community College District

(15) 5. Which of the following **best** describes how scanning is conducted at your institution? (circle one)
   1. Ad hoc studies only (e.g., studies in response to specific events or issues)
   2. Periodically updated studies (e.g., labor market assessments targeted at specific occupations)
   3. Structured data collection and processing systems
   4. Other (please specify) _____

(16) 6. The motivation for our scanning activities is **usually** (circle one):
   1. Crisis initiated
   2. Decision and issue oriented
   3. Planning process oriented

(17) 7. The data included in the environmental scan are **usually** (circle one):
   1. Retrospective - a means to assess what we have done
   2. Current - data for immediate use
   3. Prospective - forecast of the future

(18) 9. The environmental scanning information is used **principally** to guide decisions in what time frame (circle one):
   1. Immediate
   2. Near-term future (1-5 years)
   3. Long-term future (more than 5 years)

(19-22) 10. In what year did the college start environmental scanning? _____

(23) 11. What office or position coordinates and/or directs the environmental scanning activities? (circle one)
   1. Chief Executive Officer
   2. Vice President (or equivalent) for Instruction
   3. Vice President (or equivalent) for Administration
   4. Vice President (or equivalent) for Student Development/Services
   5. Director of Institutional Research and/or Planning
   6. Other (please specify) _____

(24) 12. How many individuals are directly involved in environmental scanning?
   1. One person does it all
      What is the title of this person? _____
      To what position does this person report? _____
   2. 2 - 5 people
   3. 6 - 10 people
   4. 11 - 20 people
   5. 21 - 35 people
   6. 36 - 50 people
   7. More than 50 people

13. Who participates in the scanning? (circle all that apply, and indicate how many of each group participate.)

	Group	Number
(25-27)	1. Administrators	_____
(28-30)	2. Faculty	_____
(31-33)	3. Classified staff	_____
(34-36)	4. Professional/Technical Staff	_____
(37-39)	5. Students	_____
(40-42)	6. Governing board members	_____
(43-45)	7. Community members	_____
	8. Others (please specify)	
	_____	_____
	_____	_____

14. What kinds of printed and/or electronic information sources are scanned? (circle all that apply)

(46) 1. Labor market assessments
(47) 2. Classified/help wanted ads in newspapers
(48) 3. State-wide data bases
(49) 4. Nation-wide data bases
(50) 5. Professional literature (e.g., Chronicle of Higher Education, journals, newsletters, research reports, etc.)
(51) 6. Popular literature (e.g., newspapers, Newsweek, Time, etc.)
(52) 7. Sectional literature targeted to a specific interest or group (e.g., Business Week, Working Woman, Computer World, etc.)
(53) 8. Environmental monitoring publications (World Watch, etc.)
(54) 9. Futurist literature (The Futurist, Future Survey, What's Next, etc.)
(55) 10. Systems reports (college, state departments and governmental agencies, higher education reports, etc.)
(56) 11. Other (please specify) _____

15. What additional strategies are used to scan for information? (circle all that apply)

(57) 1. Conducting focus groups
(58) 2. Conducting locally developed surveys
(59) 3. Reporting on informal conversations
(60) 4. Gathering data from key informants
(61) 5. Other (please specify) _____

(62) 16. Do you utilize a specific model for environmental scanning (e.g., the EDQUEST model for strategic planning)?

(63-72) 1. Yes -----> if yes, please specify _____
2. No

(11) 17. Who interprets the raw data for possible implications for the community college? (circle all that apply)

(1) 1. The individual who collects it
(2) 2. Members of environmental scanning team(s)
(3) 3. Administrators with expertise in the relevant area
(4) 4. Faculty with expertise in the relevant area
(5) 5. Other (please specify) _____

18. How is the information compiled? (circle all that apply)

(6) 1. As a summary of each item or article
(7) 2. As a composite of several similar items
(8) 3. As a written scan and forecast without implications
(9) 4. As a summary with implications
(10) 5. Other (please specify) _____

19. By whom is the information compiled? (circle all that apply)

(11) 1. The individual who collects it
(12) 2. Members of environmental scanning team(s)
(13) 3. Administrators with expertise in the relevant area
(14) 4. Faculty with expertise in the relevant area
(15) 5. Other (please specify) _____

20. What kinds of products result from the scan? (circle all that apply)

(16) 1. Newsletter
(17) 2. Data base
(18) 3. Formal printed report
(19) 4. Other (please specify) _____

(20) 21. How often is scan information communicated?

1. Weekly
2. Monthly
3. Semi-annually
4. Annually
5. Other (please specify) _____

22. How is the information used in the college? (circle all that apply)

(21) 1. For discussion only
(22) 2. To develop alternative futures scenarios
(23) 3. In staff development efforts
(24) 4. For program planning/revision purposes
(25) 5. For institution-wide planning purposes
(26) 6. For decision-making at all levels
(27) 7. Other (please specify) _____

23. Who uses the scanning information? (circle all that apply)

(28) 1. Governing Board
(29) 2. Chief Executive Officer
(30) 3. Vice Presidents (or equivalent)
(31) 4. Budget unit heads or other "mid level" administrators
(32) 5. Planning Office
(33) 6. Faculty
(34) 7. Students
(35) 8. Community members

24. Are there links between the environmental scanning process and planning, program development, evaluation, and/or budgeting functions? (circle all that apply)

(36) 1. Links to long-range planning (more than 5 years)
(37) 2. Links to short-range planning (1 - 5 years)
(38) 3. Links to program development
(39) 4. Links to curriculum revision
(40) 5. Links to budgeting
(41) 6. Links to performance evaluation
(42) 7. Other (please specify) _____

25. Please describe the **most** successful aspect of environmental scanning and its use in your college.

26. Please describe the **least** successful aspect of environmental scanning and its use in your college. How would you improve this function?

27. As part of this project, we plan to develop a network of community, junior, and technical colleges that are engaged in environmental scanning. We would appreciate it if you would give your name and address for this purpose in the space below.

College _____

Address _____

City _____ State _____ Zip _____

Person responding to the survey _____

Title _____

Phone number (___) _____

___ Please check here if you wish to receive a copy of the results of this survey.

THANK YOU. Please return the survey in the postage paid envelope to the Eastern Iowa Community College District, 306 West River Drive, Davenport, IA 52801-1221.

Comparative Efficiency of Australian University Departments of Accounting

David Gadenne (School of Accounting, QUT) and

Barry Cameron (Academic Staff Development Unit, QUT)

Using data from the Matthews enquiry on the Accounting Discipline, the paper addresses the relative efficiency of each Australian university school of accounting by means of the Data Envelopment Analysis (DEA) technique. The results are compared with those from prior analyses of the relative efficiency of engineering and law departments. Differences in the nature and extent of data are addressed. The usefulness of techniques such as multiple regression in selecting departmental inputs and outputs for DEA analysis is addressed, as is the usefulness of DEA 'windowing' techniques for estimating relative changes in a department's efficiency over time.

In recent years comprehensive reviews of major discipline areas (including engineering, teacher education, law and accounting) have been commissioned by the Department of Education and Training (DEET) and its predecessor the Commonwealth Tertiary Education Commission (CTEC), aimed at improving higher education efficiency and effectiveness, having regard to the current status of professional education and research activities in the discipline area across Australian tertiary institutions. The techniques used to evaluate programs include: expert panels; departmental self-assessment; employer and professional association comment; faculty, student and graduate surveys; measurement of resources usage, faculty research productivity, publication and consultancy rates, and student progression and graduation rates.

Of particular interest to professionals and academics in Accounting is the Review of the Accounting Discipline (Matthews Report) commissioned by DEET in 1989 and completed in 1990 at a cost of some $700,000 over eighteen months.

The Panel's major conclusions, drawn from the qualitative and quantitative data, highlight 'major shortcomings in resource provision concerned with government funding, disposition of fee income, academic staffing, teaching and staff accommodation', and a 'failure by both the Commonwealth Government and higher education institutions to develop and adopt systematic and equitable criteria and methodology for resource allocation decisions' (DEET, 1990) Volume 1 p.xix).

The key recommendations of the Panel in relation to funding and academic staffing included:

(1) development of 'a needs-based relative funding model based on an independent assessment of relative educational needs in different disciplines' (in place of historical cost based models);

(2) allocation of a substantial portion of income from fee paying students to provide staff and facilities sufficient to meet the extra demands;

(3) adoption by each academic institution of a target student staff ratio of 16:1 for the accounting discipline; and

(4) implementation of an emergency program of staff recruitment and training based on higher salaries (including loadings where appropriate and improved working conditions (DEET 1990, Volume 1, pp.xxv-xxx)

Although the initial reaction of the Australian Vice Chancellors Committee (AVCC) was not very favourable (Eastwood, 1990), with it appearing to regar accounting's funding and staffing needs relatively of no higher priority than those of other disciplines, its attitude subsequently softened, with growing interest in and support for development of the relative funding model. As the continuing value of the model comes into question, however, and progress with the performance indicator approach to measuring and improving university department efficiency and effectiveness continues to be relatively slow, it is clear that a less expensive approach to comparing academic units' efficiencies than through review panels is needed.

Measuring Efficiency of Academic Organisational Units

A relatively inexpensive technique for comparing the relative efficiency of organisational units in the public sector, known as Data Envelopment Analysis (DEA), has been developed recently and shows promise in meeting this need and overcoming some of the inadequacies of the earlier higher education evaluation models (see Cameron, 1989).

DEA is a linear-programming-based technique for finding a piecewise linear efficiency frontier in a number of dimensions for a set of reasonably comparable decision making units (DMU's) with a number of common inputs and outputs. The technique helps to identify which resources could be reallocated for greater efficiency through determination of relatively "slack" resources.

Using Data Envelopment Analysis to Measure Efficiency

Since its development by Charnes, Cooper and Rhodes (1978) from the ideas of Farrell (1957), DEA has been used to measure the efficiency of various processes or organisations: courts (Lewin, Morey and Cook, 1984); hospitals (Banker, Conrad and Strauss, 1986); pharmacies (Banker and Morey, 1986); electric utilities (Fare, Grosskopf and Logan, 1985); Philippine agriculture (Fare, Grabowski and Grosskopf, 1985); strip mining (Byrnes, Fare and Grosskopf, 1984); school districts (Bessant and Bessant, 1980); Council rates departments (Thanassoulis, Dyson and Foster, 1987); Air Force plant maintenance (Bowlin, 1987); local education authorities (Jesson, Mayston and Smith, 1987); and university accounting departments (Tomkins and Green, 1988).

Efficiency is generally described as the ratio of (the weighted sum of) outputs to inputs, the best combination of resources such that reduction in one would reduce desired output (Eilon, 1984), and is generally measured by one of thre approaches: ratio analysis, linear-programming, or cost function methods.

DEA's measurement of efficiency is based on the concept of pareto-optimalit whereby a DMU is considered to be underperforming if some other DMU, or combination of DMUs, can achieve at least the same amount of all outputs wit less of some resource input and no more of any other resource. A DMU is said to be pareto-efficient if this not possible. Sherman (1984) found that DEA identified a number of inefficiencies missed by traditional ratio analyses in efficiency auditing. Bowlin (1987) found that DEA outperforms both ratio and regression approaches.

No amount of mathematical analysis, however, can reconcile the diversity of views concerning priorities in the public sector, as implicit in the list of output measures chosen is ultimately a political judgement (Smith and Mayston, 1987 DEA permits each DMU to be rated along its best dimensions; each could be expected to seek expansion of the set of input and output variables to include other variables on which it considers itself to perform well, consistent with DMU effectiveness criteria. The number of inputs and outputs in DEA should be kept as small as possible, however, with at least two DMUs for each input or output measure (Bowlin, 1987).

Smith and Mayston's and Nunamaker's (1985) tests of the sensitivity of DEA to data errors suggest robustness and reliability. Field studies are needed to ensure that opportunities for greater efficiency from resource reallocation identified by DEA do actually exist and can be effected by management practice.

Linear Programming for DEA Analysis

DEA requires the solving of the objective function (input and output levels) for each DMU while having the full set of DMU production functions act as constraints along with the inputs for the particular DMU as the final constraint.

The LP software calculates the objective function, slack on each input and output, and a shadow price for each constraint. Where the objective function value is 1, the DMU is rated efficient. Where the DMU's objective function value is $<<1$, the shadow prices indicate weightings to calculate the composite DMU which "envelopes" the relatively inefficient DMU. (See Cameron, 1989, Tomkins and Green, 1988 or Jesson, Mayston and Smith, 1987 for an elaboration of the technique).

Earlier Studies of Australian University Department Efficiency Using DEA

Cameron (1989) analysed by DEA data for 23 Engineering schools and for 12 Law schools from the CTEC discipline reviews of Engineering and Law. The data in those reviews were much more sparse than for Accounting, probably because institutions did not keep comparable data at anything like the current level of detail now required and available.

Seven engineering departments (Curtin, QIT, UTS, Adelaide, SAIT, RMIT, and Queensland) were not on the efficiency frontier when the following inputs and outputs were used:

inputs:
- number of academic staff 1986;
- number of technical support staff 1992
- minimum student entry centile rank

outputs:
- average apparent completion rates 1979-83;
- total EFTSU 1986;
- average Bachelors degree graduates 1984-8
- average postgraduate diploma graduates 1983-85;
- average higher degree graduates 1983-85;
- average research expenditure 1984-86;
- relative publication rate 1982-86 in journals;
- relative consultancy rate 1982-86.

Three **law** schools were not on the efficiency frontier (Adelaide, UTS, and ANU) when the following inputs and outputs were used:

inputs:
- undergraduate students (headcount);
- % staff with law qualification;
- FT equivalent academic staff;
- recurrent expenditure budget;
- law library volumes; and
- number of periodicals in law library.

outputs:
- number of graduates;
- % staff publishing;
- publications score (calculated);
- students expressed as WSU;
- number of research grants;

No attempt was made in either case to compare the DEA outcomes with qualitative judgements by discipline experts. The data were clearly inadequat for any such comparison to be meaningful.

As Cameron's (1988) paper on the extensive work on developing higher education performance indicators suggested, there remains considerable difficulty in ascertaining and articulating the purposes, inputs, outputs and processes which are important to higher education's effective operation and o which it should seek to be efficient. It was argued then that the use of rather limited aggregate data on students, staff, finance, research and publication, and library holdings clearly ignores the importance of data on access to equipment holdings, maintenance of physical facilities, the quality of graduate and institutional processes of management and change.

Measuring Efficiency in the Accounting Discipline, using DEA

Selected input and output data (refer Figures 1 and 2, available from the authors) for 1988 (which had fewer missing values than for 1989) on Australia higher educating accounting departments presented in the Matthews report were analysed using the Linear Programming (simplex method) routine within STATGRAPHICS version 4.0

In the initial DEA model using all input and output measures, all of the institutions were on the efficiency frontier. This is not surprising in view of the relatively large number of inputs and outputs 'explaining away' a large proportion of the differences among DMU's and the considerable homogeneit in accounting departments as a result of accreditation requirements of the professional accounting bodies.

Determining Essential Inputs and Outputs for Efficiency Measurement

The quality of results in DEA is of course dependent on selecting key input and output measures. We followed Golany and Roll's (1989) suggestion that the initial list of inputs and outputs could be refined progressively using:

(i) judgemental screening, to distinguish between the factors that are 'essential' and those of lesser importance through redundancy (or duplication) or usefulness in illustrating efficiency rather than determining it; and

(ii) non-DEA quantitative analysis, which may consist of aggregating data (where possible) and a series of regression analyses to eliminate redundancies and reduce the list of input and outputs. In addition, oth multivariate techniques such as canonical correlation may be used to identify the more crucial factors.

(iii) DEA analyses of the revised list of key inputs and outputs. In each successive DEA run, factors which are consistently associated with ver small multipliers (ie. have little impact on the efficiency scores) may be eliminated.

Judgemental screening by a panel of QUT accounting academics suggested that:

(i) the value of input measures such as lecture and tutorial contact hours was questionable (within the context of a number of institutions which have recently changed contact hours without apparent detriment to thei programs);

(ii) subjective output measures relating to graduate evaluations of accounting courses may not be based on informed judgements concerning comparability to other university departments;

(iii) the output measure of professional year pass rates is probably the most 'objective' measure of graduate quality, as the professional year requirements are established by an independent national accounting body (ICAA);

(iv) the information conveyed by the input measure of expenditure on academic staff per EFTSU is already aggregated in other input measures (ie. EFTS and total direct expenditure);

(v) the output measure research expenditure adds little to the total expenditure measure; and

(vi) yearly completion rates are probably redundant if graduate numbers ar included.

On multiple regression analysis (within the MANOVA procedure of SPSS-X) th following output variables showed a significant ($p<.05$ or better) correlation with given input variables:

outputs:
- equivalent full time student units
- consultancy in teaching field
- staff in professional service
- refereed articles and publications
- number of graduates

inputs:
- equivalent full time staff, total direct expenditure, and academic work experience
- percentage of staff with course work master
- 5th percentile of scored applicants
- percentage of staff with PhD or research Masters
- total direct expenditure and 5th percentile o scored applicants

The multivariate test of canonical correlation using outputs as the dependent variables and inputs as the independent variables suggested links as:

outputs:
- equivalent full time staff and equivalent full time students
- research students, refereed publications, other publications, and number of graduates

inputs:
- total direct expenditure
- % of staff with PhD or research Masters, years of academic work experience, and the 5th percentile score of applicants.

Testing the Input-Output Model with DEA

The model thus suggested for testing with DEA had 7 inputs and 9 outputs, compared with 10 inputs and 19 outputs in the original specification in which all departments were on the efficiency frontier. The final list of inputs and outputs was:

Inputs:	
EFTS	equivalent full time staff (academic)
TOT EXP	total direct expenditure
%PHDRM	% staff with PhD or Masters by research
%MAST	% staff with coursework Masters
YRACAD	years of academic work experience
YRPROF	years of professional accounting work experience
5TH% APP	5th percentile of scored applicants

Outputs:	
EFTSU	equivalent full time students
RES-ST	research students 1989
CONS	days/year consultancy in teaching field
PROF	% staff giving professional service
REFPUB	refereed articles and publications
OTHPUB	other publications
RES-GR	externally-funded research grants
GRAD	number of graduates
PROFYR	professional year pass rates

The DEA analysis indicated that three institutions did not lie on the efficiency frontier:

Department:	Reference Set:
Accounting Department at University of Wollongong (.88)	University of Newcastle, the University of Queensland, and Flinders University
Business School at Ballarat University College (.91)	RMIT and the Tasmanian State Institute of Technology
Department of Accounting at Victoria College (.98)	Brisbane College of Advanced Education and the Tasmanian State Institute of Technology.

Perhaps Matthews' institutional reports may shed light on how each of these three institutions could increase relative efficiency, and show what can be learned from the institutions which comprise the reference set for each.

(1) **Wollongong:**
The Department has goals related to its research profile and degree structure which, if achieved will enhance its reputation. However the Panel 'gained an impression that the Department has not been managing its student intake to take account of its funding, but there is some doubt about the extent of its control'. (DEET, Vol.3, p.141, 1990). The Panel also concluded that 'student numbers have increased but staffing has not kept pace, creating teaching and resource difficulties which the Department's own policies have accentuated'. (DEET, Vol.3, p.144)

(2) **Ballarat University College:**
'The Accounting Program at Ballarat appeared to the Panel to be well structured and organised, although the Panel had some concerns about the extent to which procedural details and memorising content were emphasised in some subject areas'. Furthermore 'the Panel encourages the initiatives that are being taken in staff development and hopes that, through this process, significant improvements can be made to the academic profile of the accounting staff'. (DEET Volume 3, p.324).

(3) **Victoria College:**
The main strength was thought to be its quality of teaching. However, 'the Panel felt that the poor staffing position of the accounting discipline, caused in part by College appointment policies had potential to damage the Department and the B.Bus'. 'The discipline should also review the teaching methods used by staff, in view of its claim of teaching excellence and the moderate rating given to the degree by students and graduates' (DEET Vol.3 p.458).

As our purpose is to extend awareness of DEA and suggest some possible uses of the technique, we will not quote what the Report had to say about the reference set departments. Nor is it our intention to suggest that the three departments identified in our analysis are less efficient than the others on objective criteria. Accountants have their own interpretations of the data and comments in the Report (and on the usefulness of each).

As yet, there appears to be no consensus on the efficiency or quality of the various departments, nor on the nature of data from which such judgements should be made. Amalgamations and changing patterns of staff and student numbers, moreover, would make 1988 "efficiency" scores mainly of historical interest and attempts at generalisation from 1988 data to the present inappropriate.

Comparing Efficiencies Across Time

The DEA analyses reported here compared academic units' performance within a single time period. What might be of more use to institutional planners would be a way of comparing a single unit's efficiencies across years, or comparing a number of units across a common time period. Such an activity is of course readily possible with DEA.

There is nothing in DEA which makes assumptions about the worth of particular apparent objectives or resource choices; nor is there anything in DEA which precludes the DMUs being separate units at different times using different combinations of resources to achieve different patterns of objectives. DEA could be used to provide multiple windows through which to view and compare the efficiencies of units over time, or even to include notional inputs and outputs for a future budget period to ascertain whether any of the possible scenarios gives greater efficiency scores than those in the present or past.

DEA in a "Performance Indicators" Context

Greenberg and Nunamaker's (1987) proposal that performance ratios with which managers are familiar and comfortable be included in DEA analyses of efficiency seems quite useful. Their demonstration of such an approach in hospital administration may be of interest to higher education planners and may allow some integrated use through DEA of the ratios which will be calculated within the quantitative performance indicator wave about to sweep across Australian higher education.

Perhaps DEA may even be able to play a role in higher education resource allocation such as meta-analysis has played in the social sciences: bringing some order or relatedness to apparently inconsistent findings and setting agendas or areas for further productive research and practice.

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STRATEGIC PLANNING AND RESOURCE PLANNING IN AN INSTITUTION WITH A LIMITED DISCRETIONARY INCOME

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AIM

This paper analyses as a case study a multi-faceted process used by Swinburne Institute of Technology to link strategic planning with resource planning and allocation in order to ensure that strategic goals are pursued and implemented and that, accordingly, qualitative improvements in higher education are being achieved. It attempts to demonstrate that, even though only limited financial and human resources may be available to undertake new initiatives or to enable strategic goals to be pursued effectively, targeted resource planning and allocation methods can be used which produce cultural change and desired outcomes and improvements.

SIGNIFICANCE OF TOPIC

Higher education institutions within Australia and New Zealand have in recent years moved increasingly towards a process of strategic planning in order to manage more effectively their responses to the needs of the communities they serve as well as to government, to their own institutional goals, academic pursuits and individual staff development. This cultural shift is occurring within a system which has limited discretionary resources, be they financial or human, to be used to adopt or support new strategic initiatives and to influence change.

What has just been written is not new. The rhetoric of planning is reasonably easy to grasp. In talking, however, to colleagues in a range of institutions we have found that what higher education managers call strategic planning is not really that. It falls down on one or both of the following:

* the operational rather than the strategic nature of the planning undertaken; and

* the lack of sufficient discretionary income to implement or finance strategic directions in a meaningful way.

Hence as institutions we tend to have a range of operational objectives but not necessarily any sense of direction; or alternatively we have a reasonable idea of our strategic direction but limited additional resources to make it happen.

It has therefore become necessary for institutions to generate more of their own discretionary income, to investigate and adopt new approaches to resource planning and allocation and to take hard decisions to reorient human and financial resources from non-strategic to strategic activities. This is often difficult to achieve because of the high percentage of staff with specific rather than general knowledge and skills and with funds committed to existing activities and staffing resources, both of which may not be able to be phased down or out easily or reoriented to new directions. Methods for achieving and funding strategic change within an environment with only marginal flexibility need, therefore, to be designed, trialled and examined for their effectiveness.

STRATEGIC PLANNING IN TERTIARY EDUCATION: LITERATURE REVIEW

Although the literature is rich in papers on strategic planning or corporate planning as applied to tertiary education institutions, there is a paucity of information on the links between strategic and resource planning within such institutions. It is the purpose of this section to reference some of the work done in this area in the past.

Green and Monical (1985) indicate that strategic planning poses four basic questions:

. Where have we been and where are we now?

. Where will we be in the future by following the present course?

. Where do we want to be?

. How will we get there?

To answer these questions the authors suggest that there are four phases of strategic planning including environmental scanning and analysis, institutional mission and objectives, departmental goals and strategic formulation and development of action plans and priorities. They also indicate a number of pre-conditions for strategic planning to be successful within a higher education environment as follows:

(a) Political problems will emerge in the implementation of strategic planning unless there is an acceptance of planning techniques by the people involved in the planning process.

(b) Participants' cooperation in the planning process is essential to its success.

(c) There needs to be firm commitment by all who are involved in the planning process to devote the extra time and energies needed to plan successfully.

(d) The Chief Executive Officer must be convinced that planning will improve the institution's performance and create a more competitive edge for the academic areas in the institution.

(e) The Chief Executive Officer must be directly involved in the strategic planning process.

Green and Monical (1985) make the point that most educational costs are semi-fixed, that is, they vary little in the short run. This makes it difficult for institutions such as Swinburne to effect large changes in resource allocation to management units between any two given years. However, these authors indicate that the Washburn University (their case study) has been able to achieve a link between strategic planning and budget planning through the establishment of one committee which is responsible for decision making in the two areas. Washburn University does not put the cart before the horse and undertake the strategic planning cycle prior to the budget cycle.

Forster (1990) presents a contrasting case study at the University of Minnesota. This university is six or seven times larger than the previously mentioned case study institution of Washburn University. Forster mentions the considerable difficulties in linking the university's strategic plan to the budget plan because of the following factors:

(a) A major proportion of funding of the universities occurs through government sources which provide funding and public goals in terms of enrolment profiles.

(b) However, the university's strategic plan is principally directed at improving the quality of teaching and research objectives which are very difficult to sell to the general public.

(c) Owing to the entrenched political interest within the university and the semi-fixed nature of educational costs, it is virtually impossible to re-allocate resources internally. Rather, the strategic initiatives have been funded at the University using discretionary income, for example, interest earnings.

Forster (1990) suggests the following solutions to the problem of linking strategic and resource planning:

- more effective communication to both internal and external stakeholders about the relationship between the goals is important;
- re-allocation of funds over a longer period for the achievement of academic priorities, that is, marginal re-allocations each year so as to effect significant changes over a period of time;
- budget decisions should be made on data which is public and the decision-making process should be fully open and public.

Meisinger (1990) provides a comprehensive account of the difficulties in linking planning and budgeting in higher education. He suggests that higher educational planners who are seeking the perfect relationship between planning and budgets are "like physicists who are searching for the unified theory of forces". Meisinger suggests that both are confounded by the unexpected complexities in the physical world and the world of organised individuals. Meisinger indicates that planning theories conceptually link planning and budgeting by calling for clear statement of their goals (the plan), a set of objectives for which priorities have been established (the strategic plan), an implementation framework that estimates the cost of achieving these objectives and allocates funds for those objectives (the budget) and a scheme for measuring the success in achieving the objectives (the accountability). However, he believes that such prescriptions are too simple to account for the complexities of the real world.

Meisinger notes the following obstacles in linking planning and budgeting in higher education institutions:

(a) Some believe that human beings have a limited power to discern the future and hence, the cost of planning is too high compared to benefits resulting from it.

(b) Much of the campus planning is issue specific and it is difficult to create linkages between planning and budgeting due to problems of coordinating the numerous issue-specific planning processes.

(c) A tension exists between planning and budgeting because of insufficient resources to satisfy plans.

(d) Often the people involved in planning are not the same as those involved in budgeting. The point is made that planning should involve broader participation than is possible with budgeting.

(e) As noted by other authors, Meisinger indicates that changes in budgets generally occur at the margins due to a high proportion of expenditure in salaries (usually up to 80%).

(f) Academic units are perceived as viewing planning as a way to expand budgets whereas central administrators look at planning as a means to justify budget re-allocation and reductions.

Meisinger suggests a number of ways of reducing the tension between planning and budgeting. It is suggested that the more planners and budgets interact with one other, the more congruity there would be between plans and budgets. He contends that, unless planners converge on a list of priorities at the same time as budgeters converge on the financial plans, planners and budgeters will be out of synchrony and in tension with one another. Meisinger believes that financial flexibility can be created by either transferring vacant positions of departments to faculties or from faculties to the centre. Such funds can then be used to resource strategic initiatives.

In summary, the literature has not provided any mechanisms for effectively linking budgeting and planning. The Washburn case study is, we believe, too simplistic in assuming that if the same committee makes decisions on planning and budgeting then somehow the two elements will naturally be integrated in people's minds. We do not support such a contention but feel that the planning process should provide specific mechanisms for linking the two elements, as achieved at Swinburne.

CASE STUDY

Swinburne Limited is both an Institute of Technology and College of TAFE governed and managed as a corporate entity with a single Council and management structure. It provides educational programs in both divisions in the fields of applied and industrial sciences, humanities and social science, graphic design, business and engineering in a continuum of programs ranging from apprenticeships, post-trade certificates, advanced certificates, associate diplomas and diplomas, through undergraduate degrees to graduate certificates, graduate diplomas, masters degrees and doctorates. The educational divisions are supported by a central corporate division for their administrative and service requirements. Planning within the institution is coordinated through the Joint Planning Committee which comprises representation from the Council, Institute, College of TAFE and Corporate Division. It is this committee which in recent years has become increasingly significant in managing Swinburne's move to a strategic planning ethos and in suggesting new initiatives for ensuring that the strategic plan and its subsets of plans are effectively implemented.

Swinburne has been trialling a number of new methodological initiatives for itself in order to produce a turnaround in its efforts to develop within the framework of its key strategic goals of:

. university of technology status;

. enhanced research activity;

. curriculum integration within a multi-sectoral institution;

. improved physical infrastructure and space availability.

These new methods have been spread across a number of areas but have been seen by senior management as being part of an overall strategy to improve the likelihood of achieving institutional goals. They have included:

* introduction of an internal relative funding model for teaching program planning;

* a formal strategic planning and performance review process involving all management units and including:

  . annual operational planning within a set of strategic and operational goals; and

  . allocation by the Joint Planning Committee of a proportion of extraneous funds to support strategic initiatives;

* staff development planning in terms of strategic goals as well as individual needs;

* introduction of research management coordination and planning through key groupings, concentrations and institutional emphasis; and

* extraneous income earning to provide some flexibility; this has effectively allowed the previous four methods to be implemented.

None of these management tools is in itself unusual. What is, perhaps, somewhat different in Swinburne's use of these tools are the communication links that it has attempted to forge between them in order to produce a comprehensive and integrated strategic management system within a devolved management structure.

Swinburne has decentralised its management structure so that decision making can be devolved to the grass roots level. This has been done for a number of reasons. First, it is acknowledged that decisions made as close as possible to the point of implementation of programs are qualitatively the best for the organisation concerned. Secondly, we believe that decentralisation minimises the bureaucracy in our organisation. It is hence, not surprising that Swinburne expends a lower proportion of its budget on non-direct teaching cost centres (33%) as compared with the average for the unified national system in Australia (40%). Further, Swinburne wishes to place perhaps a little bit more emphasis on doing the right thing than doing the thing right. It is contended that the latter is the hallmark of a highly bureaucratic organisation. However, in a decentralised organisation with some devolution of the strategic planning process to the management units, we believe that cost centres will be able to identify more effectively their future directions; that is, the right things will be undertaken by them given their strengths and weaknesses and opportunnities and threats. Finally, as pointed out by Green and Monical (1985), decentralisation promotes a horizontal organisational structure rather than a pyramid type structure. Past studies have indicated that pyramid or hierarchical structures are less conducive to the implementation of innovations than a flatter organisation.

Building on the potential benefits to be derived from a responsive, devolved management structure, Swinburne has undertaken four significant and interlocking developments in the past four years. Together these developments provide methods and associated resources whereby attention can be focused on the achievement of the institution's priorities. These developments are discussed below in the chronological order that they were introduced.

1. Teaching Profile Planning and Budget Allocation

Swinburne has for many years linked its teaching profiles plans and funds allocation to the management units. It is argued that this does provide a link between one of the aspects of strategic planning (its enrolment planning dimension) and resource allocation within higher education institutions. It is noted further that such a link between planning and budgeting is also congruent with the DEET profiles exercise.

Swinburne's relative faculty funding model has been developed to allocate funds to the faculty which is then responsible for the funding of its constituted departments with appropriate integration of faculty strategic plans with budget plans. The Dean is responsible to the Chief Executive Officer of the institution to ensure that this occurs as well as to provide accountability for the monies allocated. The Swinburne relative faculty funding model has the following components:

(a) A fixed cost component which provides the establishment costs of the faculty (this figure has been kept to a minimum by providing for the salaries of the Dean, Secretary to the Dean and an Assistant Registrar to the Faculty).

(b) A variable component which is essentially student load driven.

The variable component allocates relative weights to different programs according to their discipline and academic level (undergraduate, postgraduate course work programs and postgraduate research programs).

It can be seen that the Swinburne relative faculty funding model is somewhat akin to the DEET relative funding model. However, the fixed cost component is an important difference. Swinburne is currently aspiring to develop a multi-sectoral institution with programs ranging from certificate to doctorate level. In addition to providing articulation and credit transfer from TAFE to higher education programs, it is envisaged that the higher education component of the institution will emerge as a university of technology. Clearly, in such a transition, some incentives need to be given for the development of higher degree research programs. This together with the perceived costs of such programs is the reason for the greater weighting assigned to the research academic programs.

There are a number of problems in linking budget plans to only the enrolment plans of an institution. Higher education has both teaching and research functions. Whilst the student load measure is an adequate surrogate variable for the teaching mission, it does not adequately address the research mission; it is accepted that higher degree research is linked to the overall research efforts of the institution but does not provide the complete picture. Further, quality issues concerning both teaching and research are not adequately measured by student load. These qualitative issues and strategic initiatives need to be funded through a separate mechanism from the relative faculty funding model. Swinburne has recognised this need by integrating the allocation of some of its discretionary income through its strategic planning mechanisms coordinated by the JPC, its staff development planning and research management planning as a means to pursue strategic goals and achieve quality improvements in educational program delivery. It is noted that DEET also recognizes this point by funding teaching and research infrastructure separately from considerations of the relative funding model.

2. Strategic Planning Process

Swinburne has had a highly structured strategic planning process since 1987 but has only since 1990 made a formal link between strategic planning, human resource management, research management, equity and financial allocation. Previously, devolved management units largely determined their staffing requirements, teaching and research directions with little reference to Swinburne's strategic priorities. Units were encouraged to use their discretionary income to pursue specific strategic priorities but this was not mandatory and therefore accountability for achieving these priorities or working towards them was very limited, if not non-existent. Responsibility for achieving strategic goals and associated change rested largely with central management and its access to a small pool of centrally controlled discretionary funds.

In late 1990 Swinburne's Joint Planning Committee (JPC), the body responsible for strategic planning, adopted a proposal from the Chief Executive that a small proportion of the total budget be retained from the annual budget process to be reallocated as a separate exercise to management units according to commitments they made to pursue particular strategic priorities. The JPC wanted to strengthen the relationship between management unit annual reporting, performance assessment, forward planning and resource allocation by developing an iterative process which allowed and encouraged more interaction between the JPC, the Directorate and management units. It accepted that within Swinburne performance-linked resource allocation could only be at the margins because of the high level of financial commitment to recurrent activities. It believed, however, that marginal funding should be used to assist and encourage management units to work towards the achievement of strategic priorities and to reward management unit performance in attaining agreed goals.

Determination of the allocation of this small amount of discretionary funds was undertaken as part of an interactive reporting and planning process between the JPC and the management units. This involved the following components:

(a) a written report by every management unit on its actions in achieving its targets as specified in its 1990 action plans determined twelve months previously; this material was used both by the JPC for assessing performance and also by the Directorate in the preparation of the institution's Annual Report;

(b) a written statement of both the existing and proposed activities of the management unit which were in line with Swinburne's strategic priorities, including:

- the priority which the unit put on these activities within the context of its own operations;
- the amount of money the unit had already allocated or was prepared to allocate to the pursuit of these priorities for the coming budgetary year; and
- what extra funding support for these activities the management unit was seeking from the JPC.

(c) a further written statement of any other new action plans and targets, including priorities and budgetary requirements, which the management unit wished to pursue but which fell outside the institution's strategic priorities;

(d) a discussion between the head of the management unit and the Joint Planning Committee concerning the planning submission and funding request;

(e) the determination by the JPC of funding allocations to the management units to assist them to achieve their commitments in respect of the institution's strategic priorities.

More than fifty submissions for strategic funding support were received from the eight management units. In reaching its funding decisions the JPC asked all of its members to assess individually the likely impact of each of the various management unit action plans and funding bids in facilitating the achievement of the institution's strategic priorities. This involved assigning to the individual proposals a score ranging from -10 for a very high negative impact to +10 for a very high positive impact. These weightings were then analysed in two separate ways. The first involved the statistical measurement of the mean impact scores assigned by the JPC members to the proposals. The second method involved a simple ranking of those proposals which received majority support from the JPC for a positive to very high positive impact. While the statistical crudity of both these approaches is acknowledged, they did result in a degree of similarity in their outcomes as to those proposals which were deemed to be of greater or lesser significance in their likely impact on Swinburne's strategic development. Given, however, that the funding requested exceeded the available pool of money by a ratio of approximately 2:1, a further selection process was required. Three further criteria were therefore applied:

- the willingness of management units to make a partial contribution of their own funds to their proposals was taken into account as a sign of their commitment;
- indications of past performance as based on the management units' annual reporting submissions were considered;
- a spread of funding across the strategic priorities was sought.

The outcome of this process was that approximately half of the submissions were selected to receive funding support from the JPC.

Despite the somewhat cumbersome nature of the process as it was trialled for the first time, a number of positive features emerged from the overall exercise. The most obvious outcome was that, for the first time, a formal link was established between the strategic plan and resource allocation, thus providing the opportunity to pursue strategic priorities more determinedly. An important secondary benefit derived from this linkage was that, because of the prospect of receiving additional funds, management units were inclined to think more seriously about their own commitment to pursuing institutional objectives. This and the fact that they were required to be interviewed by the JPC resulted in better, more focused and more realistic strategic planning. Finally, by being able to compare submissions from various management units, the JPC was able to suggest linkages and joint or collaborative approaches to certain strategic activities to be managed between more than one management unit or even coordinated across the institution. Apart from the professional benefits of such collaboration this should also result in some cost efficiencies, particularly in areas involving new technology or the development of new teaching techniques.

Criticisms of the exercise centre on its operational processes rather than the concept itself. It proved to be time consuming for the JPC at the awkward time of the beginning of the teaching year. This may be adjusted. It also generated a lot of paper as some areas were still inclined to make ambit claims, often in the process confusing operational and recurrent activities with action plans to achieve strategic goals. It is expected that a second iteration of this process will result in a tighter focus. Finally, as already mentioned, the method of weighting and prioritising funding bids proved to be more subjective than might be considered desirable. More work is required to improve the process of assessing the likely impact of various action plans on the achievement of strategic priorities.

3. Staff Development Planning

The third development is within the area of human resource management. In 1990 policy changes were made to link staff development more closely to Swinburne's pursuit of strategic goals. A completely revised staff development policy explicitly stated that staff development and training must be closely linked to the Institute's mission as laid out in the Strategic Plan. All management units have been required to prepare staff development plans as part of their preparation of their annual action plans within the framework of the Strategic Plan. In preparing these plans management units have been expected to take cognisance of any training and development requirements that might be required to pursue particular strategic priorities. For example, a priority within the context of equity and access might be the provision of training for some teaching staff to acquire ESL (English as a Second Language) teaching qualifications. Another example would be the upgrading of skills both to undertake and to supervise research programs and projects. Or again, with the development of a totally integrated management information system (MIS) it has been necessary to ensure that all appropriate staff will as necessary receive training in the use of and access to the MIS; this involves not only administrative staff knowing how to input and access data but also academic managers responsible for departmental and faculty resources knowing how to generate specific management reports.

In terms of structures and communication channels the management unit staff development committees are accountable to an institutional staff development committee which in turn reports annually to the Joint Planning Committee. This structure was consciously chosen to encourage relevant planning at the devolved management unit level while at the same time emphasising overall strategic coordination through the JPC.

4. Research Management Planning

At the same time as the provision of staff development and training was being specifically restructured to assist in the pursuit of the institution's strategic goals, Swinburne's research activity was also being restructured. Partly as a result of DEET and ARC preferences and partly as a recognition of the need to maximise the benefits to be achieved from its research strengths and limited research funds, Swinburne has focused its research activity into a few major groupings to provide a stronger, better defined and more competitive research effort in areas of strategic significance for Swinburne. Its research management plan has been developed as the research component of the Strategic Plan, thereby not only giving due recognition to research as a strategic priority but also ensuring that it receives major consideration for resource allocation during the budgetary allocation cycle. This has meant an enhanced weighting assigned to research teaching programs within the variable component of Swinburne's relative funding model. It has also meant that it has received additional discretionary funding from the Joint Planning Committee, particularly in the area of developing research skills. In summary the identification of a strategic priority of research development has resulted in one aspect of staff development planning being focused on research training and in this priority being resourced not only through the recurrent budget but also through the allocation of discretionary funds both directly to research programs and also through relevant staff development activities.

CONCLUSION

Over the past three to four years Swinburne has been moving gradually towards a multi-faceted management approach to its strategic planning. Having started with a top-down/bottom-up, highly structured planning methodology but unlinked to resource allocation, it has refined this process to link discretionary resource allocation to strategic priorities. It has also increased the level of communication between the management units and the Joint Planning Committee by requiring not only written submissions of action plans but also by introducing a formal interview and presentation phase into the process. This is in addition to the informal interaction that has always occurred between the Directorate's Planning Office and the management units.

There has been a further extension of the strategic planning and resource allocation processes into three other key areas, staff development, research management and teaching profile planning. The first of these is attempting to ensure the provision of training and development programs which meet the needs of the organisation and which take into account its strategic directions. The second area of research management is also highlighting the requirement for planning, prioritisation and targeted resource allocation, not only to research projects but also to ensuring that staff have the knowledge and skills to undertake research. The third area has given the management units greater control over their teaching programs, associated staffing and budgets.

In all three areas, however, mechanisms have been established to ensure that devolved decisions take into account the strategic goals of Swinburne. Consultative structures allow management units and research groupings to remain responsible for their staff development, research and teaching activities but within a more coherent institutional strategic planning framework. The key to the success of this devolution has been the linking of all aspects of planning to resource allocation, annual performance reporting and accountability.

By taking the strategic planning methodology and structures and applying them to other areas such as staff development, research management and teaching profiles, Swinburne is gradually improving its capacity to take integrated decisions which are more likely to ensure that all its resources are used in such a way as to help it to achieve its strategic goals. The basis of this process is one of coordinated communication between the management units, the Joint Planning Committee, the Staff Development Committee, the Research Advisory Committee and the budgetary process.

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LIMITED ENTRY AND MANAGED ENTRY: *AD HOC* RESPONSES AT THE DEPARTMENTAL LEVEL TO THE STUDENT NUMBERS PROBLEM

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Although New Zealand universities have traditionally operated an open entry system, the reality in the last decade has been quite different. At the University of Canterbury, pressures caused by a mismatch between University resources and unprecedented growth in enrolments have provoked an increasing number of departments to opt for restricted entry. There have been two approaches to restricted entry: first, and most commonly, departments limit entry after the maximum manageable enrolment has been reached or exceeded; second, and more rarely, departments manage entry by setting enrolment maxima before these are reached. Both these approaches, occurring as they do at the departmental level, can be described as *ad hoc*, since they merely shift the pressures to other departments. Meanwhile, the University maintains a facade of open entry.

Departments are required in selecting students for restricted entry first year courses to give equal preference to first-year and advancing (i.e. non-first-year) students of 'equivalent academic merit'. The difficulties associated with this requirement will also be discussed.

INTRODUCTION

Universities in New Zealand have traditionally had an open entry policy. When the constituent colleges of the University of New Zealand became universities in 1962, this policy was enshrined in their founding Acts. For example, the University of Canterbury Act 1961 states that: "Every person who is academically qualified for entrance to a University in New Zealand in accordance with the requirements of the Universities Entrance Board shall be eligible to matriculate at the University without further examination".[1] The level of academic qualification required was set comparatively low by international standards with University Entrance being awarded at the end of the penultimate year (sixth form, year 11) of secondary school although most students enrolling at University had completed a further year (seventh form, year 12) of study. Mature students, without formal entrance qualifications, were also permitted to enrol if they could provide persuasive evidence of potential for academic success. Despite the open entry policy and although strong in the field of access of mature students, New Zealand universities have been described as being low in the area of core participation (18-24 year olds).[2] This, to a large extent, reflected the fact that retention to the upper levels of secondary schooling was also comparatively low. But it is clear that if all the school leavers who were eligible to enrol at university had done so the policy of open entry would have been seriously challenged much earlier than it was.

Of course, the policy of open entry to universities never extended to all individual degree courses. The expensive professional schools such as Medicine, Dentistry, Architecture, Veterinary Science, Engineering, etc. had always set limits on the number of students admitted and selected their students from those who completed the appropriate first year university "Intermediate" courses.

The founding Acts of the universities recognised the possibility that students might not gain open entry to every faculty or department. Among a list of reasons that a University Council could invoke to decline enrolment to a student (reasons such as the person not being of good character, or being too young, or having breached discipline,

or having failed to make sufficient academic progress) was: "Insufficiency of accommodation or of teachers in the University".[3] In 1977 the university Acts were amended and the phrase above was modified to read as follows: "Insufficiency of accommodation or of teachers in the University or in a faculty, department, class, or course of the University: 'Provided that the Council shall exercise its power under this paragraph in accordance with criteria and procedures prescribed from time to time by it after consultation with the University Grants Committee'".[4] The way was now clear for the imposition of limitation of entry as we now know it.

LIMITATION OF ENTRY AT THE UNIVERSITY OF CANTERBURY

In 1978, a year after the university Acts had been amended as above, the Professorial Board of the University of Canterbury requested the Academic Administration Committee (AAC, a committee of Deans) to examine the question of limitation of entry to courses of study and to particular courses and to make recommendations concerning:

"1) The University's general policy concerning such Limitation
2) the grounds upon which and procedure through which such Limitation may be imposed; and
3) the criteria to be applied in selecting students where such Limitation is imposed".[5]

At that time 12 limitations were listed in the University of Canterbury Calendar ranging from a limit of 850-900 enrolments in the School of Engineering to a limit of 10 for the M.Sc. in Resource Management. None of the limitations in force affected large classes in the general degree courses.

In 1979, the AAC, after extensive consultation, reported back to the Professorial Board. In their report, under the heading "A General policy/philosophy for Canterbury", there was acceptance that there may be a point varying in direct proportion to accommodation and staff, beyond which an increase in enrolment would result in the lowering of course quality below the acceptable standard, which might justify limitation of entry. Although the committee accepted that accommodation constraints might be alleviated by the repetition of classes they acknowledged that then the availability of staff might prove a constraint.[6] They also foresaw that the University's staffing position was unlikely to improve but were concerned that this might lead to a "spate of hastily introduced limitations" rather than to an awareness of the need for the University to be innovative in its teaching. "Limitation", the report stated, "must remain the 'remedy of last resort'[7] and "insufficiency of accommodation or of teachers is rightly held to be the only ground upon which the University may proceed [to limit courses]."[8] In specifying a procedure through which limitation should be imposed the AAC declared itself to "feel strongly" that any initiative in the matter of a specific limitation must come from the department, faculty or Board of Study responsible for the particular course.[9] That is, there was no support expressed for the possibility of limitations on student enrolments being imposed upon departments.

The AAC said that in seeking limitation, the Head of Department would provide

evidence that:

"(a) a review of the structure and number of courses offered at all levels had been undertaken
(b) the availability of increased accommodation had been investigated thoroughly
(c) the use of different pedagogical methods had been examined".[10]

As far as criteria for selecting students for limited entry courses were concerned, the AAC wanted an emphasis on the "twin criteria" of academic attainment and potential for success. The committee believed that each department should develop its own criteria for selection and that criteria should not be imposed upon departments.[11] For first year courses, which the committee said should "only in the most unusual circumstances" be subject to limitation of entry, preference was to be given to first-year students and to advancing (non-first-year) students who wished to major in the subject or who wished to major in a subject for which the limited entry course was a pre-requisite.[12] In 1982, the Department of Accountancy introduced limitation of entry to its first year courses and in 1985 the Department of Economics followed suit. Enrolments in large first year classes were finally being limited. As these limitations began to 'bite' the students rejected sought to enrol in other departments; at the same time, as the employment situation worsened, many more students were retained to the higher levels of secondary school and then enrolled at University. More and more limitations to first year courses were sought and granted: a domino effect became apparent.

In the meantime, in 1987, the University Council asked that the AAC's 1979 report on limitation of entry be referred to the Professorial Board for reconsideration and report back. Again the matter was referred to the AAC which in due course produced the Guidelines for Limitation of Entry which are still in effect in 1991. Interestingly, in the introduction to its 1988 report the AAC said that it had "become increasingly aware that it is desirable for each department to estimate the number of students that can be accommodated with its current resources before that maximum eventuates. To request a limitation on this basis", the report continued, "can be regarded as management of entry, which may be preferable to requesting a limitation after the maximum student number has already been reached or exceeded. It may well be that in the present economic climate the University should seriously consider adopting managed rather than open entry as its basis for admission".[13]

The 1987 Committee expressed the belief that both the general philosophy on limitation of its 1979 report and the procedures for imposition of limitation and selection needed extensive revision and clarification in order to "acknowledge present circumstances". It therefore, under the title 'General Philosophy', recommended that the University of Canterbury acknowledge that specific circumstances may require the imposition of limitation of entry, that the factors for justifying limitation "shall be insufficiency of teaching staff and/or facilities for effective teaching at acceptable standards", that in seeking limitation a department shall demonstrate that all other reasonable options have been explored and that limitation is the best of the available options".[14] Once again, the imposition of limitation was to be left to departments, although in considering at

which levels (first year, second year, third year) to introduce it, departments were asked to consider their existing responsibilities to the University and to the community at large.[15] Finally, it was suggested that departments, in conjunction with their annual resource planning exercise, should consider the possible need for future limitation of entry.[16] This statement of 'general philosophy' reflects a distinct shift in attitude to limitation which has moved from being a "remedy of last resort" to "the best of the available options". This can be seen as a more realistic view in light of the worsening resource situation of the University. Limitation of entry was now seen as a *fait accompli* and the AAC's report almost seemed to be encouraging departments to consider it before their situation became desperate. Once again, the initiative for requesting limitation of entry was 'normally' to come from the department concerned, preferably before the student numbers had reached any limit. Detailed evidence to support limitation was now required to describe the present situation, the proposed limitation including "possible impacts on other departments or courses" and "possible consequences for students, such as stranding [being stranded]", and the selection criteria proposed.[17]

As far as the selection of students is concerned the 1988 Guidelines require that as a general principle "selection shall normally be on the basis of academic merit with particular reference to performance in relevant subjects. However, departments should also take into account other indications of potential for success in the course ... and any special circumstances relating to the student, the course or the needs of disadvantaged members of the community."[18] For the purposes of selection for first year courses, normally, the Guidelines say, equal preference should be given to candidates in their first year of university study and to non-first-year candidates of academic merit equivalent to that of the first-year candidates considered.[19]

The 1988 Guidelines for Limitation of Entry remain in force in 1991 and since they were adopted in 1988 they have been used with increasing frequency as more and more departments, particularly in the Humanities and Social Sciences, seek a solution to the big increases in student numbers which have particularly affected the Faculty of Arts. As has already been explained, both the 1979 and 1988 reports on limitation expressed the opinion that any move towards limitation should be initiated by the department concerned i.e. that limitation should not be imposed upon departments. This reflects the very much devolved decision making ethos which is current at the University of Canterbury. Theoretically, there is nothing to prevent a department continuing to accept enrolments far beyond its ability to do justice to its students, its staff, or its courses. However, to allow such a situation to continue might seem to be a dereliction of duty on the part of the University and contrary to its Charter which promises to "provide the best possible resources and teaching to enhance the intellectual development of its students."[20]

In 1991, faced with the prospect of almost all the major Faculty of Arts departments imposing limitation of entry in 1992, it is the Students' Association (which, incidentally, has a policy opposed to limitation) which has moved to set up a committee of faculty representatives (mainly Deans) to consider limitation and examine the case for the University to impose a University-wide limit on student numbers.[21] This is a decision that three other New Zealand universities have already made, and was a move that the 1987 AAC report appeared to advocate. Recently, the Vice-Chancellor has also asked

faculties to consider managed entry involving departmental quotas across faculties, although it is not clear how this would differ from what will be the reality in the Faculty of Arts, at least, in 1992.

In the next section of this paper examples of the imposition of limited entry and managed entry on first year courses in two departments will be described. In that both these approaches to the student numbers problem occurred at the departmental level, neither did anything to control the overall intake of students to the university. What they and other limits on entry have done is simply shift the student numbers problem to other departments for them to deal with. Because departmental initiatives to restrict entry provide relief only for the departments concerned, both limited entry and managed entry as practised at the departmental rather than the supra-departmental level can be regarded as *ad hoc* responses, albeit well considered and scrutinised, to the mismatch between student enrolments and university resources.

LIMITED ENTRY AND MANAGED ENTRY IN STAGE 1 COURSES

As has been previously explained, entry to some degree courses has always been restricted but students have been selected on the basis of their performance in an Intermediate examination taken in the first year of university study. A new approach was required when the selection of students for first year courses arose. For new entrants to the university, there was a difficulty because although there is a relatively high correlation between performance in the final school Bursaries examination and first year university examinations (more true in Science, less true in Arts, Law and Commerce) not all entrants sit this Bursaries examination. Also, there are substantial proportions of non-first-year students in first year classes (ranging from 20% to 80%). To be fair to all students with potential for success, the 1988 Guidelines on Limitation of Entry state that 'normally' equal preference should be given to first-year students and to non-first-year students of "academic merit equivalent" to that of the first-year students considered.

Establishing the levels of 'equivalent academic merit' for first-year and non-first-year students is a task that few departments have attempted and it is noticeable that there is a trend towards publishing less specific selection criteria. Even fewer departments have checked the validity of their selection criteria after the event. The University, in its 1991 Draft Charter, states that it will promote the well-being of its students by, among other things, operating "fair procedures for the selection of students for limited entry courses".[22] Although current selection criteria and procedures are less than perfect and some students are undoubtedly treated unfairly by them, good students have no problem enrolling in the courses of their choice.

Limited entry in Law

The Department of Law introduced limitation of entry to their second year classes in 1985 but entry to the first year qualifying course, The Legal System, was not limited until 1989. The limit was set at 400 students (plus up to 10 "whose personal history or circumstances and potential for success indicate ... that exemption from the normal

criteria is warranted");[23] this compared with an enrolment of 480 in 1988. Very detailed selection criteria were published e.g. in the first category were

(a) students in their first year of University study who are holders of a University Junior Scholarship, or an "A" Bursary [the best entrants]; together with

(b) students previously or currently enrolled for a university degree who have been credited with not less than 24 points and have obtained a B average grade in their previous university studies ... .[24]

In order to establish the levels of equivalent academic merit within each selection category the Department of Law asked the writer to analyse the performance of recent students in the class in terms of their previous academic performance, at school or university. This proved to be a relatively simple exercise since the course had traditionally had a low pass-rate and it was possible to distinguish the performance of the various sub-groups of students. In addition, because it has almost twice as many applicants as places available, the Department of Law is able to choose the better qualified students whose performance is more predictable. It has also, after each of the two years that the limitation has been operational, checked that no major discrepancies in the performance of equivalent groups of first-year and non-first-year students are occurring.

Managed entry in English

Until 1991, only one Department had, to use the terminology of the 1988 Guidelines for Limitation of Entry, requested the introduction of a system of managed entry to all their undergraduate courses. 'Managed entry' was defined as the application of limitation of entry before the maximum numbers of students that could be accommodated within current resources had been reached. In 1990, the Department of English moved to set maximum numbers for all its 24 under-graduate courses. Numbers were set according to the size of teaching rooms available, the teaching methods used (lectures and tutorials or lectorials) and the availability of staff. Overall numbers at all levels were set higher than in 1990 but in a few individual and more popular courses lower than in 1990. Selection, where necessary, was to be determined by academic achievement. For first-year students, academic achievement was to be assessed on the basis of overall results in 6th form (year 11) and 7th form (year 12) examinations. For non-first-year students, academic achievement was to be assessed on the basis of grade point average in their last year of university study.[25]

After its one experience of selecting students for its five first year courses, the Department of English has already changed its selection criteria for 1992. Provided with ranked lists of the grade point averages of non-first-year students and with alphabetical listings of their actual academic records, the person responsible for the selection found more comfort for his choices in the academic records and made what he terms "motivated choices". As far as first-year students were concerned preference was given to the better entrants from the seventh form (year 12) and to mature students. No formal attempt was made to set levels of "equivalent academic merit" for first-year and non-first-year students and, if anything, "increasing leniency" was shown to the latter

students who had already proved themselves in the system. Due to "administrative difficulties" the Department of English actually enrolled far fewer students than the limits it had set for its first year classes. New administrative procedures are therefore also planned for 1992.

CONCLUSION

In 1992, similar selection exercises will be carried out in more than half of the departments offering first year courses. Students will be accepted, wait-listed or declined entry in any or all of the courses for which they pre-enrol. Judging by this year's experience many will pre-enrol in more courses than they can possibly hope to enrol in in order to 'hedge their bets'. The prospect is frightening. The alternative, some process of managed entry at the University or even at the faculty level is looking increasingly attractive to many of those involved.

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FACULTY DEVELOPMENT THROUGH COLLEGIAL STRATEGIC PLANNING

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ABSTRACT

This paper describes a process of collegial strategic planning that is being used in a higher education institution to arrive at an agreed set of revised Faculty objectives and strategic plans. The plans are the basis for actions in the Faculty, institution and community in the coming years and provide a framework for regular reviews of objectives, strategies and operational structures. The nature of this process is compared with those described elsewhere and the methods and outcomes discussed.

The principles and processes described are believed to have general applicability to settings like those found in most higher education institutions where there is a tradition of participative democracy in decision making.

INTRODUCTION

The nature of strategic review and planning processes as they can apply to higher education settings has been documented to a reasonable extent in the past decade. Kotler and Murphy (1981, p. 470) describe "strategic" market planning as apparently appropriate for colleges and universities if they are to survive the troubled times ahead.

> It is one of the most revolutionary commercial sector developments in the last ten tears and promises to be a potent tool for use in nonprofit organizations.

Cameron (1983) outlines three types of adaptive strategies that colleges and universities might employ in the face of the conditions of decline. The approaches proposed were developed by making comparisons with similar private sector circumstances and include domain defense, domain offense and domain creation, implemented in sequential order (p. 376).

Barton (1988) draws attention to the fact that

> the recent Green Paper, *Higher Education. A Policy Discussion Paper*, proposes that strategic planning be adopted by all tertiary institutions as part of a new style of management (p. 51).

This suggestion was subsequently included in *Higher Education. A Policy Statement* (1988). Barton further

> explains the nature and advantages of strategic planning, and the major elements involved in stategic planning within an analytic framework. Various strategies... are examined, with an emphasis on their financial aspects (p. 51).

Kelly and Shaw (1988) report on a comparative analysis of strategic planning in Australian manufacturing companies and academic institutions in metropolitan Melbourne and Geelong, Victoria. Included in their findings are several of significance for this report. First (p. 69), that various conceptual frameworks and techniques had an even lower degree of influence on academic institutions' processes than was the case in corporations, where it had been very limited (in 1982, when that survey was conducted). Second (p. 69), that the processes employed in only one of the ten institutions surveyed had indications of being bottom-up for the development of corporate goals.

> At academic institutions the role of top management and to a lesser extent the chief executive officer are downplayed in favour of second level line managers who are seen to exert the most influence on the setting of goals for their areas.

Third (p. 75), that

> at this stage academic institutions cannot provide a sufficiently precise and detailed profile of internal performance. .... essential for any meaningful assessment of educational effectiveness and efficiency to be made and can only be achieved by the use of more refined empirical measures than those currently employed.

Kelly and Shaw also suggest (p. 76) that, while there is a lag between corporations and academe and that such a delay may be helpful considering doubts about the extent to which corporate planning contributes to overall performance, there remain benefits in the process of planning.

Port and Burke (1989) provide a description of the steps through which higher education institutions can develop and benefit from a structured approach to business planning. These are similar in conception to those described by Kotler and Murphy (pp. 471-88) and Barton (pp. 54-61) , and implied by Kelly and Shaw (pp. 66-74), but slightly more detailed.

Sizer (1987) discusses funding cuts that have been experienced by British universities, considers some policy implications and the managerial roles of chief executive officers. In a section dealing with managerial guidelines for financial reductions a range of strategic planning elements is presented (pp. 366-9). Included in the list of twenty guidelines are

> Communicate and consult extensively with departments, staff and student unions in order to obtain agreement to the planning process, ...and to identify them with the philosophy of the plan. (9, p. 367)

and

> Accept that extensive argument, debate and controversy may have to be tolerated as part of the process of gaining acceptance of hard and difficult choices (11, p. 367).

West (1988) discusses strategic planning and performance indicators in contexts related to international experiences and

> joint influences of continuing reduced resources, demand for research to solve short term economic problems, and the perceived value in the application of business models of management. (p. 5)

He identifies and discusses the tensions that exist in applying strategic planning in a collegiate environment and the limits that might result in the range of options that can be achieved (pp.11-13).

Jones and Lewis (1991) describe the implementation and outcomes of a case study in which Aschuler's strategy was used to bring about collective change in an educational organisation. The approach is interventionist in nature and assumes that if the change is initiated and supported in an appropriate manner it will be selfsustaining. The strategy comprises identification of a group ready for change and key decision makers within the group, identification of a problem which would provide an accepted focus for the intervention and the establishment of an appropriate staff development program. It is offered as a strategy that is effective and

> sufficiently general to allow transfer to a range of environments but specific enough to be able to be translated into action.(p. 51)

Bienaymé (1989) makes a strong case for the recognition of the central place and inclusion of practising educators in planning educational futures but does not follow this with mechanisms or suggestions through which it could be achieved.

The processes undertaken in the study described here were designed to respond to several factors identical to those described in the literature. These included a perception that higher education institutions are efficient at "operations" more so than longer term strategic planning (Kotler and Murphy, pp.470-1, Kelly and Shaw, p. 75) and that there are increasingly demanding imperatives for responding to changed circumstances (e.g. Barton, pp. 51-4, Sizer, pp. 354-371).

From within there was also a perceived need to diversify the operations of a faculty in the college sector about to join the Unified National System in a way that preserves existing strengths, and an overwhelming sense that some proactivity in shaping futures was an essential element in doing this in an orderly manner.

On the bases of both a broad consensus within the Faculty and support from other sectors of the College's management a decision was taken early in 1990 that the Faculty of Education would undertake a strategic review and planning process.

THE STRATEGIC PLANNING MODEL

The approach chosen for the Faculty's process was a modified version of the National Industry Extension Service strategic planning model (NIES, 1988). The modifications that were made relate to the manner in which the implementation was enacted and focus attention on the nature of academic institutions, notably the tradition of collegiality in decion making processes.The NIES model is identical in conception to that cited in Port and Burke.

Kelly and Shaw describe a model similar to these as

> heavily influenced by structural-functionalism and general systems theory (p. 66)

in line with current organizational theory.They add

> the...model focusses on the organisation and its environment and on the formal strategic planning system as a subsystem of the organisation. ...the focus is on the organisation's goals and strategies, its size, structure and ownership aspects, its information and decision processes, and its reward subsystem (p. 66)

The models suggest a three stage process during which there is a strategic review, an analysis and a strategic planning phase. In this case the review considered mission statements, resources, marketing and markets, programs and the environment in which the organisation is operating. The analysis resulted in the identification of key factors contributing to current successes, the equivalent of a SWOT analysis and conclusions that resulted from the analyses. The strategic plan comprised a restatement of objectives, an operations plan with discrete consideration of program developments, staff development, physical resources, systems developments, financial plans and structural reorganisation, and an implementation schedule. Each aspect of the operations plan had associated recommendations, outcomes against which achievements could be gauged and timelines to indicate the rate of progress.

It is worth noting that all but one of the references included here (i.e. Sizer) make no specific direct reference to a process through which members of an organization can contribute democratically and completely to the development of a strategic plan. A range of other contemporary texts surveyed on the subject of strategic planning or management make no reference to the importance of collegial or democratic planning processes. Greenley (1989) in *Strategic Management* provides a typical example, taken from McGlashan and Singleton (1987), of the meaning of "bottom up" in this context.

> as many managers as possible from many levels of the hierarchy should be encouraged to participate in the formulation and selection of strategy. Although this may be idealogically beneficial it is unlikely to be practical, except in relatively small companies with only a single business (p. 259).

and

> a major consideration is whether the board of directors should lead the development of strategy, or whether this should be delegated to senior management (p. 260).

The view held in this case was that not only did all staff associated with the Faculty, numbering fifty and including a range of support staff, have contributions that could improve the resulting objectives and strategies, but also their inclusion is an important first step towards the realization of outcomes.

IMPLEMENTATION

The strategic planning commenced formally early in 1990 with the release to all staff of some written details of the nature and purposes of the process. Expressions of interest were called for the development of a range of position papers which would inform a two day retreat held midyear. A number of staff who have special expertise in an area on which a paper was to be developed were approached individually.

Papers for the strategic review were prepared on:

current aims and strategies;

the faculty's courses and students; including applicants and students' origins, progress through courses, course evaluations, and graduates' employment;

staff and staff loads;

communications;

finances;

research ;

the organizational stucture and its characteristics; and

the external environment; including National and State policies, demographic patterns, participation patterns, employment, and financial circumstances.

The implementation of the retreat followed the model indicated except that ninety percent of the staff were present throughout. Their contributions were maximized through a series of discussion groups, limited in size to ten people and, when appropriate, with memberships that were self selected.

In all instances group recommendations were reported back to the whole wherein an independent facilitator would either draw the group to consensus, or, in the small number of instances when this was not immediately possible, set in train an elaborative process prior to deferred consideration.

The retreat processes were supported by independent secretarial services.

Towards the conclusion of the retreat, several working parties formed to follow through with the development of details and documentation. Their results were circulated to staff and finally accepted unanimously at staff meetings and the Faculty Board respectively.

Since this time there have been several other retreats, conferences or workshops through which some of the more significant or pressing issues have been considered in detail.

OUTCOMES

Staff Response

Staff responses to the retreat processes were notably favourable. Unsolicited responses from more than fifty percent of the participants indicated clearly the high value they placed on having available a planning forum in which their contributions were sought, incorporated where appropriate and valued. These responses include one from a staff member who believes strongly in autocratic management styles but valued the opportunity to contribute in this way to the outcomes.

Most expressed satisfaction that the outcomes were perceived to be significant improvements on individual contributions (including theirs) and that consensus was reached in a relatively harmonious manner.

Objectives, Strategies and Intended Outcomes

A revised set of Faculty objectives, strategies and intended outcomes has been produced. They give attention to:

> the needs of people the institution serves and the provision of programs and resources to meet their needs;
>
> the manner in which needs are met and the Faculty's standing;
>
> the balance of activities, including research and undergraduate and postgraduate courses;
>
> proactivity in influencing policies and practices at regional, state and national levels;
>
> the working environment and development of staff; and
>
> operating structures that promote the achievement of objectives.

Each objective has an associated set of strategies and intended outcomes. It is or will be through the achievement of these outcomes that the success of the exercise will be gauged.

The following are provided by way of example of the extent to which there has been success after twelve months, or to demonstrate some of the associated principles that were part of the agreed package.

Outcome Example: Structure

A major revision of the Faculty structure has occurred since the planning process. The new function based structure is designed to ensure that:

> increased attention is to be paid to the opportunities that each student has to receive a unified course of the highest quality (through the creation of course coordinator positions in the structure);
>
> research activities across the Faculty will be further promoted and facilitated ; and
>
> promotional opportunities for outstanding performances are more likely to be available.

A principle implicit in the decisions to review regularly the strategic plans, and to continue to refine their detail, is that the Faculty structure will continue to evolve. There is widespread (but not unanimous) agreement on this issue. Another, on which there is also widespread agreement, is that the democracy and openness which characterized the review and planning should be reflected in the future operations of the Faculty. Not all of the answers are available to the question of how this is to be achieved.

The timescale for the restructure was left imprecise in recognition of the need to consider very carefully all of the detail involved in major change, to allow time to have accepted maximally the changes and to secure the appropriate institutional approvals. Delays that were not forseen include award restructure and necessary internal administrative procedures. These have resulted in minor irritations, particularly in delays to plans for staff development intended to support new roles and to action for the implementation of the full range of strategies.

Outcome Example: Budget

The 1990 budget process for 1991 was modified in recognition of the retreat principles and outcomes to become one in which all faculty budget processes were critically analysed and disclosed to all those who hold budget responsibility. The bases for receipts and allocations are now substantially understood by all participants and useful discussions between providers and recipients are now more frequent, purposeful and fruitful.

Staff involved in this process are unanimous in their support for the process (but not necessarily for the results). Reasons cited by all Heads of costs centres include the benifits of being clear on current financial statuses in toto and, when used in conjunction with student load systems, having the capacity to analyse and prepare for future situations.

More substantial and longer term benefits relate to budget managers' capacities to contribute to Faculty planning in more profound and extensive ways.

Outcome Example: Student Load Distribution

A number of strategies and their associated outcomes demand a higher degree of control and predictability over the levels and distribution of student load in courses. A series of spreadsheets have been developed through which these can be calculated and estimated within the limits of future uncertainties. These have informed collegiate discussions and decisions at staff and Board meetings on the shape of student loads in courses, the Faculty and the University.

Elements of systems design (Kotler and Murphy, pp. 487-8, Sizer, p. 366) like this last example and the preceding one related to budgets have emerged as unanticipated outcomes in the sense that they occurred to inform the processes more rapidly and extensively than would otherwise have been expected.

Outcome Example: Partcipation in Postgraduate Developments

One retreat outcome requires diversification to a balanced engagement in preservice undergraduate programs, postgraduate and nonaward programs for people in educative practices and research and consultancy activity. Staff teams have developed two new courses for this purpose, contributing substantially to a shift in the course mix.

In 1990 the ratio of undergraduate to postgraduate students was 0.74:0.26. In 1992 this is expected to be 0.71:0.29 on the way to 0.61:0.39 in 1994.

Shifts of these magnitudes in a student population of about seven hundred effective full time student units require, among other things, extraordinary efforts, changes in work patterns and goodwill from staff across a faculty. Their participation in the processes through which the decisions have been taken are expected to be an important (and perhaps essential) contributor to success.

CONCLUSION

The reservations raised by West concerning potential limitations to the range of achievable options as a result of an internal collegiate process are legitimate concerns. Here again is raised the dilemma of choosing a balance between reasonable plans with a high likelihood of success and highly regarded plans with a reasonable chance of faithful implementation.

This question must ultimately be answered with action of some sort. For those who seek proactive participation in their futures, ultimately seems to be closing in very rapidly and decisions need to be made. It will be the actions through which institutions move purposely into their futures that are key determinants of whether overall purposes are met. It is conceivable that planning could become a preoccupation at the expense of sensitive implementation.

Would these developments have occurred regardless in a well planned and tightly managed organization? An answer to the question is not possible within the scope of this report. It would be useful to include mechanisms for investigating it in future studies.

What does seem certain is that the collegial processes described would make an autocratic leader of an academic unit(s) feel quite uncomfortable. Equally apparent to participants are the values of inclusion and unity of purpose and action that have been generated in this case.

It is initially surprising to find that even in institutions which appear to have long established traditions of collegiality in academic life the predominant methods employed to plan strategically are strongly hierarchical. From the literature found in preparation for this study Sizer appears to be alone in providing a description of a model and operations that are sympathetic to democracy, collegiality and the activities described in this work. His guidelines seem to be well grounded in experience, sound in conception and extent, and consistent in their capacity to employ practices that are well known in academic life.

Evidence presented here indicates that collegial strategic planning can provide effective and highly regarded means of responding positively to the rapidly changing circumstances facing universities in Australia.

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REFLECTION AND FUTURE DIRECTION

IN TERTIARY EDUCATION:

AUSTRALIA'S EDUCATIONAL REFORMS

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INTRODUCTION

Structural changes in tertiary education have occurred on a global scale for the past decade or so. Generally, these changes are in response to the prevailing economic, technological and demographic trends. Two basic international trends can be discerned, namely,

a. the movement towards smaller numbers of large, multi-purpose, multi-discipline tertiary educational institutions; and

b. the autonomy of tertiary educational institutions is conditional on meeting the objectives set by the government, such as demonstrating efficiency and societal relevance (Goedegebuure and Meek, 1991:7).

Australia's current educational reforms are effected by the same economic, technological and demographic considerations. Nations, like Australia, have to respond to the challenges of competing for scarce resources in a world environment scrambling for economic growth through productivity gains and broadening the market share. In the new economic order, there is recognition that countries which invest most in education will be the most competitive.

Naisbitt and Aburdene (1991:3), in their expositions on the challenges of the Information Age, argued the need for tertiary education institutions to respond pro-actively and intelligently in developing educational and training programs which can produce people "who can think critically, plan strategically, and adapt to change". This is the essential requirement of a brain-based society or a clever country (Toffler, 1991).

In the light of these global changes, what strategic response should tertiary education institutions take would be a key consideration of educational planners and managers. An important first step in any strategic plan is the understanding of the operating environment at the global, national and local level. The purpose of this paper is to provide an exploration of the changes in tertiary education brought about by government reforms in the West and Australia. Underlying this general purpose are the following aims:

1. To examine the tertiary education environment in a global context by comparing Australia's reforms with the other Western industrialised countries,

2. To explore the responses of our tertiary education institutions to these reforms, and

3. To consider the future direction of tertiary education in Australia and in this context, a multi-sectorial (TAFE-Higher Education) model is put forward to illustrate the likely structural and managerial trend in which Australian tertiary education institutions may adopt.

EDUCATIONAL REFORMS IN THE WEST AND IN AUSTRALIA

Neave and van Vught (1991:239) gave a comprehensive account of the educational reforms in the West since the end of the Second World War. The increasingly important role of government in tertiary education planning has been influenced by two main factors. These factors are:

1. the rising tide of 'social demand' for tertiary education which leads to the rapid expansion of tertiary education systems; and

2. the policy of governments to match the production of the tertiary education system with workforce demand and the requirements of the labour market.

The concerns of these factors and the steps taken to deal with them by governments have often been interpreted as direct intrusion and a threat to autonomy by tertiary education institutions. This fear of the consequences of government intervention in tertiary education had begun in the 1970s when governments resorted to using financial stringency and budgetary compression to pressure institutions to achieve operational efficiency and management rationality. The same kind of pressure continued into the 1980s.

Two important developments occurred in the drive towards efficiency among the institutions in the 1970s and 1980s, viz.,

a. the "significant changes in the process of management at institutional level; and

b. the reinforcement by government of 'contracting' as an instrument of direction and the particular weight attached to the issues of quality and accountability" (ibid.:242).

In 1991 the situation is no different. Tertiary education institutions in Australia, Belgium, Ireland, the Netherlands, Norway, the United Kingdom, and the United States still face the problems of resource constraints . Yet institutions are expected to achieve efficiency by

* turning out more graduates at less cost,

* enrolling more students, and

* achieving economies of scale (mainly through institutional amalgamation as in the case of Australia and the Netherlands).

These developments have required tertiary education institutions to demonstrate their own capacities for strategic management which include:

a. the ability to use resources efficiently in accordance with set objectives; and

b. the foresight to develop institutional plans over the medium and the long term which can respond both creatively and directly to the political and economic environment.

In the United States, United Kingdom, Germany, the Netherlands, Norway and many other countries, governments allocate funds on the basis of the strategic planning documents submitted by the institutions, showing their ability to achieve economic efficiency, quality of outcome, student access and accountability. In addition the tertiary education sector needs to adapt to the raised expectations of the community and to provide relevant quality education to a growing and increasingly diverse student body (Nicholl, 1991:5).

There are some striking similarities in tertiary education reform and restructuring in Australia, Europe (such as The Netherlands, Norway, Federal Republic of Germany, the United Kingdom, France, Ireland and Sweden) and the United States. Some of these similarities are:

1. The tertiary education system in Europe and Australia (and to some extent the United States) has been characterised traditionally by strong, centralised bureaucratic control. Institutions have to adhere to the elaborate regulatory frameworks in order to secure their funding. In recent years, despite the restructuring, this central control has not weakened.

2. Reduction in the number of institutions by means of mergers or amalgamations and the concomitant enlargement of the size of establishments with more diversified teaching and research programs.

3. Minimum enrolment levels set for institutions. In the case of Australia, a minimum student load of 2000 is required before an institution can become a member of the Unified National System. In the Netherlands, it is 600 students.

4. Institutions are required to operate in accordance with market developments like business corporations. Attention is focused on profiles, increases in the numbers of graduates and institutional performance, a diversified student supply, and better adjustment of course supply to labour market demands. Governments seem to take the view that if institutions are allowed to (or are forced to) compete more directly with a free and open market, they will become more efficient and effective, more responsive to industrial needs and economic imperatives, more productive and better managed.

5. Establishment of a unified national system (UNS) which

   * eliminates differences in status between different kinds of education on the same level;

   * facilitates the choice of studies for the students and the allocation of resources to studies of similar kinds;

   * meets the demands for research connections between different types of tertiary education without setting up separate and small research departments outside the university;

   * facilitates transferability of credit between all types of institutions within the system;

   * facilitates enrolment in post-secondary training programs from all types of undergraduate training; and

   * facilitates the development of new courses through the use of modules from the various disciplines and departments.

The exception is the Netherlands in which restructuring has brought about the formal establishment of a binary system of tertiary education.

How tertiary institutions have taken to these reforms in Australia is discussed in the next section.

RESPONSE TO EDUCATIONAL REFORMS: THE AUSTRALIAN CONTEXT

Dawkins' (1988) "Higher Education - a policy statement", or commonly called The White Paper, set the agenda for reforms in the Australian higher education sector. The overall aim of the reforms is to create a higher education system which provides maximum benefit to individuals, institutions and the community as a whole (ibid.:11). The reform agenda which was succinctly summarised by Harman (1989:20) includes the following:

1. Abolition of the binary system and replacement by a new unified national system (UNS) of higher education.

2. Major consolidation of institutions through amalgamation to form larger units.

3. Substantial increases in the provision of student places and various efforts to improve student progress rates in order to increase the output of graduates.

4. Increased emphasis on fields such as applied science, technologies, computer science and business studies, perceived to be of crucial importance to economic recovery and economic growth.

5. A more selective approach to research funding, with increased emphasis on research on topics of national priority, and substantial increases in research funding.

6. Changes to the composition of governing bodies to make them more like boards of companies, and strengthening of management of universities and colleges, particularly to give much greater power and authority to chief executive officers.

7. Major changes in staffing, particularly aimed at increasing the flexibility of institutions, improving staff performance, and enabling institutions to compete more successfully in staff recruitment in priority areas.

8. Changes to achieve greater efficiency and effectiveness of the higher education system, including reduced unit costs in teaching, improved credit transfers and rationalisation of external studies.

9. Moving of some of the financial burden for higher education to individuals and the private sector, and encouraging institutions to generate some of their own income.

The new structural arrangements have generated heated public debate in the tertiary education community. In the area of administration, the main criticism levied against the newly adopted policy approaches was the erosion of autonomy in institutional decision making. Besides, a lot of paper work has been created for administrators, especially for the annual institutional profile exercise. The situation is further compounded by the heavier workload for academic staff and depleting teaching and non-teaching resources.

As in any reform, the initial stages can be quite traumatic. Policies are often rejected or negated by an implementation process highly influenced by entrenched institutional tradition and vested interest, no matter how rational or equitable the goals appear to be (Wildavsky, 1970). Institutions in general display an inertia towards reforms. The tertiary education institutions in particular resist change by focusing on the core operations in order to safeguard what is typical for universities and colleges.

The reforms, however, are not without its supporters. Meek and Goedegebuure (1989:16) have shown that the majority of the institutional leaders (chancellors, vice-chancellors, registrars and their college counter-parts) supported the proposed broad changes as presented in the White Paper. Their findings indicated that

* almost 70 per cent of the respondents in the survey were of the opinion that the elimination of the binary system is desirable,

* almost 80 per cent believed that competition within the system should increase and that educational diversity both within and between institutions should increase, and

* over 90 per cent felt that

  institutional management should be strengthened,

  strategic management should become an integral part of the management practice,

  there should be formal arrangements to assess the quality of both teaching and research, and

  the Australian system should develop into a more adaptive, responsive, and competitive system to face the challenges of the Information Age.

However, the evidence of an agreement does not mean that every one is happy with the reforms. The debate is still simmering. It is not the purpose of this paper to delve further into this debate which targets mainly at structural matters such as increasing the output, reducing the number of smaller institutions, shifting funding emphasis and managerial issues. We are concern with the priorities in which institutions should set in meeting the challenges of the present and future.

SETTING PRIORITIES IN TERTIARY EDUCATION

The general weakness of the White Paper is that it lacks a clearly defined set of national educational goals and rationale to guide institutions through the reforms. This issue has been a long-standing problem in the higher education sector. As far back as 1962, P.H. Partridge (1962: 53-54) has pointed out that the educational sector has overly emphasised "means and resources" and neglected the "academic or intellectual aims, achievements and condition of the universities." He added that

> "there seems to have been little curiosity about the changing character of the society of which they are part, and about their own changing functions in the social and in the wider intellectual life of the community."

In the Information Age in which we are now in, the "knowledge explosion" and the widespread changes in the social and technological arena demand a broad educational foundation in undergraduate programs. Though the White Paper has identified the problems of narrowness and inflexibility in undergraduate curricula and emphasised the need to broaden the education experiences of the undergraduates, it has not provided the implementation strategies on how this can be achieved.

The Senate Standing Committee on Employment, Education and Training (SSCOEET) in its 1990 report has identified the following priorities which institutions should set in order to provide maximum educational and training benefit to the nation as a whole:

1. <u>Quality of teaching:</u>

   Quality of teaching is an important component in developing a "clever" country. This has been a burning issue in various recent reports. The Tenure of Academics (1982), Review of Efficiency and Effectiveness of Higher Education (1986), the Green Paper and the White Paper have mentioned the importance of teaching quality.

The White Paper, for instance, indicates that the staffing policy in institutions should provide "an environment in which individual excellence in teaching, research and other related functions can be recognised and rewarded, and in which inadequate performance is not protected." In fact in the near future, funding will be increasingly based on institutional performance.

The SSCOEET (1990:57) "takes the view that the quality of teaching has a profound influence on the calibre of graduates and their capacity to contribute to the well-being of the nation." "... Australia requires graduates who are educated in the fullest sense of the term - graduates who are sensitive to the social environment in which they live and work, who are critical, analytical thinkers, and who are able to respond creatively to the challenges of a complex and rapidly changing world. These capabilities will only be fostered by a learning environment which offers genuine intellectual stimulation. They are unlikely to emerge from situations which merely encourage passive absorption of knowledge. Effective teaching is a vital factor in achieving the national educational goals of a clever country."

2. **Access to and participation in tertiary education:**

There is evidence that quality of teaching has a direct effect on attrition rates - a problem of particular interest in view of current concerns to maximise access for disadvantaged groups, and to increase the output of graduates. As cited in the SSCOEET (1990:59), a 1987 study of student performance observed that "gaining access to higher education is one thing; completing a qualification is another.... if we are serious about participation and equity, then the only way to increase graduation rates without sacrificing standards of excellence would be to improve the quality of teaching".

To increase access and participation, Baldwin (the Federal Minister for Higher Education) has proposed the following:

* that the overall adult (17-64 years) participation rate should be maintained at 1990 levels of 3.9 per cent of the total adult population.

* a higher proportion of mature-age students and postgraduates will be admitted in line with the 'clever country' economic policies.

* 1992 average operating funds per student should be used as a 'reference level' for the next ten years and 'capital and renovation funds' should remain at 1990 levels for six years.

* review of Austudy, especially dealing with problems faced by those transfering from TAFE to higher education.

* diversifying funding - institutions are encouraged to seek financial autonomy through greater degree of entrepreneurial activity. The Higher Education Council emphasises private sources of funding and industry training needs.

For effective access and participation, however, there are several barriers to overcome. These include:

* the need to simplify and to unify nationally the requirements for entry to tertiary education courses so as to facilitate access for all socio-economic groups, and for inter-state mobility by enabling students to select institutions and courses appropriate to their needs;

* a policy to provide flexible entrance arrangements as well as funding to assist disadvantaged groups; and

* the establishment of an efficient and effective national credit transfer system which also recognises skills, experience and knowledge gained outside of academic institutions.

3. **Life-long learning:**

As far back as 1974, the Kangan Report on "Technical and Further Education in Australia" (pp.17-18) made the following observation:

> "It is an unreal view of modern life that people can store up sufficient education during the compulsory years of schooling or within their initial vocational education in the trades, technologies or the professions, to last them a lifetime of change. The facts are different. To take advantage of new opportunities for personal and job satisfaction, updated job knowledge or changes of occupation, people need, and can benefit from, different addition to their education at different times in their lives.
>
> ...continuing professional education contributes directly to economic growth through skilling, re-training and updating knowledge in a climate of rapid social and technological change."

In countries of the Organisation for Economic Co-operation and Development (OECD), for example, the profound social changes that have occurred have contributed to the rapid growth of adult education. The reasons for this growth which are also applicable to the current situation in Australia, include:

* a growing recognition that the benefits of technological change can only be fully realised if people are able to acquire the necessary skills;

* a realisation that structural changes in the economy will require increasing numbers of adult workers to change occupations; and

* the ageing of the labour force, which will make it less realistic to rely on young labour market entrants as the principal source of innovation and adaptation (OECD, 1985:7)

While the Australian government has recognised the significance of life-long learning in the Information Age (also a strategy the visions of Australia Reconstructed, 1987), however, it has adopted the position of the "user-pays principle. As clearly stated in the White Paper (1988:70), professional and vocationally-based continuing education in general should operate on a cost-recovery basis, taking account of direct and indirect costs. The income generated should be used to subsidise courses for disadvantaged groups and participation by low income earners in other adult education programs. This attitude not only affects the development of life-long education, directed at updating skills, in Australia but also pays lip-service to its policy of equity and access, especially for the disadvantaged groups.

Reiterating the growing importance of life-long education in the social and economic development of the country, the SSCOEET avers that it life-long education must be the key element in Australia's education and training system. On this basis, the SSCOEET (1990:100-101) recommends the following:

* adequate funding should be provided for life-long education,

* establish a National Accreditation Agency as proposed by the Australian Association of Adult and Community Education,

* promote research and professional development in life-long education to improve the quality of services offered, and

* develop a national data base about the nature and extent of life-long education within the tertiary education system.

The SSCOEET's national priorities for tertiary education as identified in the above section seem to point to the direction of an open learning and comprehensive system of tertiary education where there are no barriers to access and participation at all levels of the educational process. As indicated by Nicholl (1991:3), the tertiary education of the future would be a system which is as open as possible, accessible to people of all ages and from all backgrounds, servicing the needs of industry, the public sector, unions and community groups. For this to occur, there is a need to establish a multi-sectoral system where the distinction between higher education and the TAFE sectors which now exists is reconstituted to form a continuum of tertiary education.

FUTURE DIRECTION IN TERTIARY EDUCATION: THE MULTI-SECTORAL INSTITUTION

At the higher education institutional level, the ability to adapt and innovate is an important issue, especially in an environment of scarce resources and stiff competition. Student growth in the past and next few years has forced many institutions to operate below funding standards and minimum space. Declining financial resources have incapacitated the ability of institutions to up-date library stock, provide pastoral services to students, renovate dilapidated buildings, and improve teaching services. Yet the pressure on higher education institutions to strengthen their competitive position is likely to intensify, rather than abate, in the foreseeable future.

Colleges of Technical and Further Education (TAFE) are under the same pressure to compete in the market place. The future of public TAFE provision is under serious review and discussion in Federal Government circles. The Deveson Inquiry of 1990, commissioned by the Federal and State governments to assess the costs and implications of training from the current overhaul of the wage award restructure, has recommended the introduction of TAFE tuition fees and a competitive training market (Spiers, 1990).

Given the complementarity of the skill orientation of TAFE programs and the more theoretical approaches of higher education institutions, it is only logical for the two sectors to amalgamate to provide enhanced opportunities for diversification of funding sources, especially due to the strong potential links between TAFE and industry. Such a system would assist in building a flexible, versatile workforce which is able to cope with rapidly changing technology.

There are, however, barriers which hamper the TAFE-Higher Education linkages owing to the historical development of the two sectors which are not encountered in most other Western industrialised countries. As such the inter-mobility between the two sectors are restrictive to the detriment of the nation's human resource enrichment. For example, Dawkins' (1987:38-39) "Higher Education, A Policy Discussion Paper" or the Green Paper has identified the wastefulness of resources, the ad hoc nature, and the many inconsistencies of the existing credit transfer arrangements.

The question of credit transfer from TAFE courses to higher education was considered as confused, erratic and arbitrary among higher education institutions. Even within the TAFE sector, the assessing of TAFE qualifications for credit was ad hoc and wasteful. The SSCOEET (1990:145) noted that it is now generally accepted that considerations of economic efficiency and social equity require that skill acquisition be seen as a potentially continuous process. There should not be any arbitrary barriers to up-grading and distortions caused by untenable policy differences between institutions. "...Action should be taken on a national (as well as State and institutional) basis to ensure systematic academic transfer and an increase in the recognition given for skills, experience and knowledge gained outside of academic institutions" (ibid.)

The White Paper (1988:36-38) did set out a number of principles designed to improve the credit transfer and course articulation situation. These principles encouraged more emphasis on standard accreditation procedures, better dissemination of information about credit arrangements, and the provision of an appeal system for the review of credit decisions. Institutions were required to adopt these principles as part of their condition for entry to the UNS. The higher education institutions, however, were concerned about the White Paper's approach to the transfer of credit from TAFE courses. They envisaged the need for bridging courses in certain cases, and that additional funding would be required for this to occur. The displeasure of higher education institutions over such an arrangement is reflected in the following statement:

> "Government must accept that such a scheme may well have a negative impact on completion rates as there are serious risks of failure for such transfering students. The University cannot accept responsibility for these risks. If unsatisfactory terms of credit transfer are imposed on this University by the government, then the University will need to maintain separate statistics on the completion rates for transfer students, and to publicise these in an endeavour to inform potential students of the risks involved (SSCOEET, 1990:145)".

Despite the concern of the higher education sector, the trend towards developing an egalitarian and comprehensive system of tertiary education is emerging in Australia, vis-a-vis, the strong trends already established in the United States and Europe. Steps taken to set the system in place include:

* the establishment of the unified national system;
* the expansion of student places;
* the introduction of award restructuring and its emphasis on career paths and skills acquisitions;
* the implementation of National Training Guarantee, and the new emphasis on staff training and development;
* the improved relations between tertiary education and industry as;
* a more enlightened attitude to credit transfer with TAFE and elsewhere;
* real commitment to equality of opportunity;
* the challenge of a revolution in post-compulsory schooling resulting in a clear majority of students remaining at school until the end of year 12;
* the need to address the problems and potential problems created for public control and accountability by a growth in reliance on private sources of funding;
* the Australian Education Council (AEC) Review Committee aims to provide "appropriate national curriculum principles designed to enable all young people ... to develop key competencies, with the associated implications for curriculum development, initial teacher preparation and continuing professional development" (Nicholl, 1991:3-5).

Perhaps the European (Swedish, German and Dutch) and Japanese models of a unitary system of tertiary education would be a good example on how our future tertiary education system should be structured. This model facilitates the transferability of credit between all types of institutions within the system and facilitates enrolment in post-secondary training programs from all types of undergraduate training. The system permits multiple entry and exit (or stop out) points so that in theory a student with say only Year 11 secondary schooling could enter a certificate course and eventually work up to doctoral level qualifications.

Such a system will be considerably enhanced through a national system of course accreditation. Students transfering from one institution to another, or from one course to another within the same institution, should be able to gain maximum possible credit for work they have already done, and the administrative procedures involved in this should be as simple as possible. Currently a TAFE course completed in one State may not necessarily be recognised in another Australian state.

Furthermore, such a unitary system should provide an effective use of the departmental system so far as departments are regarded as the basic units of the institution. This arrangement should increase the contacts of the departments with different fields of study. It implies a certain guarantee of quality with regard to curriculum contents and research connections. It also facilitates the development of new courses through the use of modules from the various disciplines and departments.

A similar model, based on Pedley (1977) and that of West Germany's "Gesamthochschule" has been suggested by Wallace (1988:2). The model promotes a comprehensive educational environment which

* provides technological, commercial and social education;
* inculcates knowledge and skills with both a theoretical and applied focus;
* encourages and develops flexible and lateral thinking and entrepreneurial flair in its students; and
* facilitates and encourages research of an applied nature.

The model is based on the "policy of integration":

* physical integration, where possible, on the one site and organisation of all staff and students under the one administration;
* "integration of the curriculum into one course system in which there are still different courses and levels of courses but which are related to each other and permit the possibility of transfer." (ibid.:3)

According to Wallace, the system would provide the community with a variety of studies and activities appropriate to meet the multitude of individual needs. " It could only have the flexibility and resources to do so if it operated within a basic unity. Such a unity would facilitate:

a. opportunities for students to transfer without handicap or embarrassment from one course to another;

b. development of inter-faculty courses;

c. co-operative policy making and planning; and

d. the rational use of resources.

It would thereby encourage the reduction and eventual elimination of social and educational barriers."

Wallace also suggested that a TAFE college be integrated with an institute of technology. In this way a fully intersectoral institution would be formed. Such an institution would offer a variety of cross-sectoral courses. It would have links with schools and would be able to educate students from certificate level through associate diplomas and degrees to doctorates.

The accreditation system would combine the strengths of the former university and the College of Advanced Education system of accreditation, that is, maintain a balance between local autonomy and the need to maintain quality of outcome and national course recognition. Perhaps an Australian Council of Academic Accreditation and Evaluation type of body could be established to accredit new courses and to periodically review existing courses. The latter should occur every 5 to 10 years in order to contain costs but also maintain sufficient accountability and currency of courses. Institutions should be permitted to amend courses in the interim period to up to 50 per cent of the curriculum but not lengthen programs beyond six months without prior approval from the central body.

As have been identified by the SSCOEET (1990:144), the advantages of an efficient and effective credit transfer system are several, viz.,

* it obviates the necessity of duplicating studies when transfering from one institution to another, or when pursuing two different but related qualifications. This is particularly important given the increasing mobility of students, and the tendency for growing numbers to undertake further studies after completion of a first diploma or degree.

* it assists students seeking to enter the higher education system after studies at TAFE level.

* improved credit transfer processes should result in more reliable assessments of previous qualifications and more streamlined administrative arrangements.

* it enables students to move as freely as possible within the system, and in which educational achievement is not blocked by unnecessary rigidities. Flexibility of this kind is an important element in coping with social and technological change.

The multi-sectoral institution, therefore, has the capacity to provide the integration of all levels of the tertiary education system and industry. Such a system would create the opportunity for interaction of skill formation, technology, work organisation, industrial relations, training and education which are so essential in determining a nation's comparative advantage in this Information Age. So instead of permitting the tremendous wastage of human resources that still exists with the current institutional arrangements, the multi-sectoral system is geared towards harnessing the human factor to the quality and productivity challenge (Dix, 1985:6). Hence, in the restructuring process, an important strategy for institutional planners and managers to consider would be the adoption of the multi-sectoral model.

CONCLUSION

Resources allocated to tertiary education are productive investments for the future. It is absolutely essential that resource inputs have the capacity to value add both horizontally and vertically throughout the whole educational linkage process. Global environmental scanning on reforms in tertiary education has shown that in the Western industrialised economies and in Japan have developed strategies to provide opportunities for value adding throughout the whole spectrum of education and training of the educational system.

In Australia, despite the rapid growth of the tertiary education sector through improved access and participation, there are prevailing barriers to intra- and inter-institutional mobility. Traditional universities, especially, still maintain an aloofness towards downstream linkage. Hence, the high wastage of human resources due to mis-opportunities and barriers to value add education and training continues.

To pursue the "clever country" ideal, there is a need to establish a new institutional structure (TAFE-Higher Education model) which facilitates movement between the TAFE and Higher Education sectors, especially in the context of credit transfer and course articulation. Such an institutional arrangement would provide opportunities for students of both sectors to have the advantages of practical skills training and conceptual learning.

It also generates maximal benefits from resources invested in the tertiary education system as well as maximisation of the individual's student's investment in education.

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A COMPARISON OF THE ACADEMIC SUCCESS OF MATURE AGE AND TRADITIONAL ENTRANTS AT THE VICTORIAN COLLEGE OF AGRICULTURE AND HORTICULTURE - DOOKIE CAMPUS.

Menon Parameswaran

The academic performance of the mature age students enrolled in the Diploma of Applied Science (Agriculture) course at the Victorian College of Agriculture and Horticulture - Dookie Campus was compared to those of the traditional entrants. The data collected on student's background prior to enrolment and their performance in the course based on the Grade Point Average (GPA) were tabulated and statistically analysed using SPSS^X program. This study also attempted to evaluate the usefulness of some of the student background variables which could be used to help identifying those students who are likely to succeed in the course. The study found that the mature age students performed equally well in the agricultural course compared to their younger counterparts. The maturity and motivation of students appeared to be the most important criteria for success in the course. Among the student background variables, the interview score (INTS) proved to be the most useful variable in identifying the potential student population for the course. Some possible implications of these findings for student selection are suggested.

In most parts of the world including Australia, educators are now realising that the future populations of colleges and universities are likely to include higher proportions of older people than ever before because of shifts in the age profile of the population. As the number of mature age students increases, educational institutions may need to know more about this cohort particularly in relation to their academic achievements.

During the last decade the Australian universities and colleges have witnessed a large influx of mature age students entering into a number of tertiary courses (Barrett and Power, 1980; Harris, 1989; Hore and West, 1980; West et al., 1986). As Hong (1982) points out "...the trend is expected to continue for some time and it seems inevitable that the mature age student body will rapidly become an important part of the tertiary education scene". There are, however, some indications of a slow down of participation by this cohort due to the government policy of economic rationalism and the introduction of the Higher Education Contribution Scheme: HECS (Currie and Baldock, 1989; Desmarchelier, 1989). The Department of Education, Employment and Training (DEET, 1989) maintains the view that this trend if merely temporary and unlikely to sustain once the people have come to grips with the 'user-pays' principle in the education sector as has been the case with other enterprises.

Admitting mature age students into Australian higher education seems to have received wide acclaim, from academics, politicians and the community at large. However, some concern has been expressed at the lack of data on the academic performance of mature age students compared to traditional entrants in many faculties of study.

The work of researchers such as Barrett and Powell, 1980; Boon, 1980; Eaton and West, 1978; Hore and West, 1980; West, 1981; West, et al., 1986 on the academic performance of mature aged students is well known in the higher education sector in this country. Based on studies carried out at the University of New South Wales, Barrett and Powell (1980) reported that the academic performance of the mature aged cohort was shown to be consistently superior to that of students entering direct from school. Out of 634 subjects studied by the mature age students over the period 1975-1978, the authors found that there were 55 High Distinctions, 205 Credits and 174 Passes, which in effect represented graded passes in 66 percent of the subjects. Unfortunately, no comparable data from the normal intake (traditional entry) was available from this particular work. However, another study also at the University of New South Wales (see Knights, 1978) showed that only 13 percent of the traditional first year students in Arts faculty achieved better than a pass grade.

From a study of the student records of 1979 Diploma of Teaching graduates at Claremont Teachers College, Western Australia, King and Haynes (1982) reported that mature age students scored significantly higher overall marks than did younger students but there was no significant difference on practice teaching marks. In regard to the latter, the most common suggestion, according to the authors, is that teachers (and Principals to some extent) in schools feel more insecurity with practice students of their own age or older and this tended to downgrade them to some extent.

As indicated the literature on the academic performance of mature age students yielded mainly studies in higher education courses in Arts, Behavioural Science, Humanities, History, Social Science and very few Science faculties. There is a lack of information in the literature available on the academic achievement of mature age students undertaking professional courses such as Agriculture, Engineering or Medicine, although some studies have been carried out with mature age students graduating from Business and Accounting Diploma/Degree courses (see Huggan, 1976). With the decline in the number of school leavers entering courses in Agriculture, it has been argued by some educationists that mature age students are a means of filling the vacant places. This argument in favour of mature age students can be substantiated only if the academic performance of these students is studied and evaluated.

Predicting students' academic success in post-secondary institutions has been of long-standing interest to institutions for two reasons: (1) to maximise the number of students who will be eligible to persist to graduation, thereby increasing the stability of the institution's economic base; and (2) either to preclude, or to provide special support for those persons who are unlikely to succeed and spare them from the psychological trauma associated with failure and the inability to attain their educational goal. It is, however, questionable whether, in practice, the second reason has been taken very seriously by many educationists.

The need for administrators in the educational institutions to be as sure as possible that the students selected for courses are more likely to succeed than those rejected, has resulted in many attributes of the prospective student being examined as what are commonly called "predictors of academic success" in the universitites and colleges.

Studies carried out in Australia and overseas (Hong, 1981, 1982; Jewell, 1990; Parkes, 1989; Van Helden, 1975; Watkins, 1979; West, 1985) have included such demographic variables as age, sex, marital status, work experience, students' motivation to study and social backgrounds as determinants to predict their academic performance. Some of these factors varied between students of different academic disciplines.

Hardesty (1980) used a multiple regression analysis of the various commonly used predictors including High School Grades in a study of academic success of degree students at De Pauw University. A sample of 1750 students entering the university over a three year period were considered in the study. Hardesty found much intercorrelation between variables - reducing their effectiveness when used together. The study showed that the aptitude test gave the best prediction followed by the high school examination results. The advantage of high school examination results as something which are readily available was acknowledged by the study. Similar findings have been reported by others (Jones and Western, 1979; Zeidner et al., 1990).

Over the years, there were many studies carried out in Australia to investigate the value of final year secondary school examination (HSC or its equivalent) as a predictor of isuccess at university particularly in the first year The views on this by educationists vary quite differently (Van Helden, 1975; Watkins, 1979).

In a study at the University of New England, Watkins (1979) found that the HSC is a moderately good predictor of university success, particularly in science based faculties. In a similar study at Wollongong University, Van Helden (1975) found that there was very little correlation between the final school examination results and university performance for students who started university studies at age 22 or over who had obtained the Leaving Certificate under the age of 20.

Research by Hong (1981) at the Darling Downs Institute of Advanced Education, Toowoomba, which made use of multiple regression analysis, investigated relationships between academic achievement and personality traits, environment and high school performance variables. Correlations between these variables were low, and explained only 24% of GPA in Behavioural Science students, leaving over 75% of GPA variance unexplained. Findings from this work and subsequent study by the author (Hong, 1982) have shown that the Tertiary Entrance Score (TES) as measured by the HSC results, was a less powerful predictor than the age of subject, study methods or environmental variables.

In the independent analysis, the multiple regression of GPA with the predictor variables ranged from 0.191 to 0.449 (Hong, 1982). The age variable was found to be the most powerful predictor, explaining 20.2% (R^2 change: 0.202) of the GPA variance followed by environment (15%), study methods (13.6%), TES (6%) and personality (3.7%). Personality was the only factor where contribution was not significant. These findings are in agreement with many Australian and overseas studies and support the view that older age students on the whole are likely to perform as well as or better than younger age students. Many other studies (Astin, 1975; Brockett,1985, Miller, 1970) however, indicate either negative or in many cases no significant relationship between age and academic success.

Many mature age students had a significant work experience break between school and college. This is considered to be as an "asset" to their subsequent studies. Surprisingly, however, very little information is available in the literature which considers the predictive value of this variable. However, Taylor and McNamara (1983) have shown that "word knowledge" score (measure of language skills) and number of months in the job are the best predictors of the academic success of students in the Civil Engineering Certificate course at Sydney Technical College. Due to the heterogeneity of the nature and duration of work experience of mature students, the difficulty one has in using and explaining the validity of this variable as a reliable predictor of academic success has yet to be established.

THE RESEARCH QUESTION

As indicated earlier there is a critical absence of adequate research evidence in relation to the academic performance of mature age students undertaking professional courses such as Agriculture, Engineering or Medicine.

The purpose of this study was to verify how the mature age students performed in the Diploma of Applied Science (Agriculture) course at the Victorian College of Agriculture and Horticulture - Dookie Campus (VCAH - Dookie) compared to their younger counterparts. The following were the aims of the study.

1. to assess the academic performance of mature age students in agricultural courses at VCAH - Dookie compared to their younger counterparts;

2. to explore the relationship between the background variables (age; work experience; interview scores; and credits received for previous studies) and the academic performance of students; and

3. to identify and appraise the usefulness of background or similar variables to predict the academic potential of students admitted to courses in agriculture.

METHOD

Source and Collection of Data

Accumulated student records covering a ten year period from 1987 to 1985 (years as different strata) were researched in order to extract relevant details about the traditional as well as mature age students. Data extracted from the student records included details on the age (AGEN), exemptions or credits allowed based on previous studies (EXEM), the duration of work experience (WEXP), and the interview score (INTS) each student attained before entry was granted.

More than 60 percent of the students in the composite sample belonged to the 17-20 year old catergory (Traditional Entry: TE) and the rest were distributed among the mature age groups (21 and over - Mature Age Entry: MAE). Among the MAE, 6 percent of the students were aged 26 plus. It must be pointed out that 3 students in this group were in their late 30's. As with similar studies, there was the difficulty in obtaining an equal sample of students for the two age cohorts in any particular year due to the limited entry under the mature age category.

Of all the students sampled, about 37 percent of the TE group had passed HSC and the corresponding figure for MAE was 15 percent. A large proportion of the latter students had either unsuccessfully attempted HSC or they appear to have left school at the completion of Year 11.

With respect to the interview score, each student was interviewed at the College on a specified date by one of the members of staff. The score for the interview was based on detailed interview scoring criteria developed at the College. During the interview, the following aspects were considered: student's interest in the area of study, reasons for selecting a course in agriculture, reasons for selecting VCAH Dookie as the institution for his/her studies, work experience, and past educational history. All these relevant variables were also taken into consideration in calculating the interview score.

The students' academic performance was recorded in the form of a grade attained in a selected group of units or subjects. The subjects were chosen to cover the different levels of study (less advanced to more advanced) spread through the whole duration of the course.

The grades obtained by students were transposed into a single numerical score, namely the Grade Point Average (GPA) according to Hong, 1982; West, 1985 using the following scale:

Failed and work incomplete (F)=1;* Fail (E)=2; Pass (D)=3; Credit (C)=4; Distinction (B)=5; High Distinction (A)=6**.

Statistical Analysis of the Data

The SPSS[x] program was used for the analysis and tabulation of the data- both t-Test and Chi-Square Test were applied to assess the statistical significance of student variables and achievement scores between the two groups.

The relationships between GPA and other predictor variables (namely: the age of students on entry, work experience, interview score, exemptions or credits allowed for past studies) were quantified using Pearson correlations and a multiple regression was used to estimate the variance in GPA accounted for by variable(s) which showed significant relations with GPA (see Hong, 1982; Watkins, 1979).

RESULTS

The Academic Achievement of Students

Table 1 shows the overall GPA values scored by the different age groups. Although the mean for MAE tends to be slightly higher, the difference between the two age cohorts was not found to be statistically significant ($p<0.05$).

Table 1 Student Performance (GPA) by Category of Entry.

Entry	Mean	Standard Error	t-Probability	TOTAL (N)
TE	3.37	0.06		66
			0.222	
MAE	3.49	0.09	n.s	47

TE: Traditional Entry; MAE: Mature Age Entry. Data on nine TE and one MAE students were unavailable.

* Student failed in all work submitted for assessment including failure to submit work or part thereof. Students in this category are now graded NN.

** Grading changed to Fail (N); Pass (P); Credit (CR); Distinction (D); High Distinction (HD).

In addition, there was also evidence to suggest that the performance of the two groups was not significantly different with respect to the distribution of grades (Table 2). In both groups more than 85 percent of students attained GPA greater than 3. It is worth mentioning that 23 percent of MAE group attained GPA between 4.0 - 4.9 compared to 14 percent by their younger traditional entry counterparts.

Table 2 Distribution of GPA by Category of Entry.

Entry	GPA Range 2.0 - 2.9 n %	3.0 - 3.9 n %	4.0 - 4.9 n %	TOTAL (N)
TE	9 14	48 72	9 14	66
MAE	6 12	30 65	11 23	47

(Chi-Square = 1.80) not significant.

Another aspect of this study was an attempt to look at whether the two age cohorts differed in their performance within a selected number of subjects studied. Subjects selected include core units (GRS_1); preliminary units (GRS_2); advanced units (GRS_3) and more advanced units (GRS_4). Table 3 summarises the student performance in the various groups of subjects. It is evident that the performance differential between the two age groups is negligible in most cases indicating that the MAE performed as well in preliminary as in advanced subjects compared to their younger counterparts.

Table 3 Student Performance (GPA) in Various Subject Combinations

		Mean	Standard Error	2-t Prob.	No. of Cases	Subjects
GRS_1						
	TE	3.41	0.07		45	MAS
				0.131		
	MAE	3.61	0.11	n.s	32	AET
						AEC
GRS_2						
	TE	3.71	0.10		44	CR-A
				0.722		
	MAE	3.78	0.17	n.s	27	PA-A
						FA-A
GRS_3						
	TE	3.73	0.14		56	FA-B
				0.328		
	MAE	3.50	0.20	n.s	36	
GRS_4						
	TE	3.47	0.13		14	FA-C
				0.838		
	MAE	3.94	0.23	n.s	6	GM
						ANH

Notes: MAS: Man and Society; AET: Agriculture and the Environment; AEC: Agricultural Economics; CR-A: Crops A; PA-A: Pastures A; FA-A: Farm Management A; FA-B; Farm Management B; FA-C: Farm Management C; GM: Grazing Management; ANH: Animal Health.
n.s.: not significant.

Prediction of Academic Performance of Students

As outlined elsewhere one of the aims of this study was to identify student background variables which could be used to identify their potential to succeed in a professional course such as Agriculture. In this study the predictive value of student's background variables such as age on entry (AGEN); work experience (WEXP); interview score (INTS); and past studies credit or exemption (EXEM) were assessed. Table 4 shows Pearson correlations between GPA and the four predictor variables.

Table 4 Correlations among GPA and Predictor Variables.

Predictors	GPA	INTS	WEXP
AGEN	0.23	0.07	0.21
WEXP	-0.10	0.22	1.00
INTS	0.48**	1.00	0.22
EXEM	0.04	0.25	-0.06

** $p<0.01$; study unit (N) = 37

Of all the subscale variables used, the GPA was found to be significantly related to INTS alone which is rather suprising. On intuitive grounds, it is reasonable for one to expect some signficant relationship between variables such as work experience or exemptions granted and the GPA due to their likely positive contributions to students' academic achievement. It is widely believed that work experience in agriculture or a related area would be of great benefit in professional studies such as Agriculture.

The data clearly indicate that the age of students on entry has little significance in relation to their academic performance.

It is noteworthy to mention the lack of relationship between INTS and the other predictor variables, thus suggesting a direct relationship exists between this variable and the GPA. The possible reasons for such relationships were discussed.

Multiple regression was used to analyse the relative powers of the interview score (Table 5) on the student GPA for the different subject groups studied.

Table 5 Percent variance of GPA of different subject groups and overall GPA accounted for by INTS.

	GRS1	GRS2	GRS3	GRS4	Overall GPA
	n=36	n=25	n=36	n=12	n=37
INTS	16.73	28.77	18.96	0.89	22.65
F	6.82	9.29	7.96	0.09	10.29
sig	*	**	**	n.s	**

Notes: GRS_1: core units; GRS_2: preliminary units; GRS_3: advanced units; GRS_4: more advanced units ; *$p<0.05$; **$p<0.01$; n.s. - not significant.

The results show that the independent variable INTS accounts for about 23 percent of the variance in GPA for the total sample ($p<0.01$), the prediction was best for the student performance in preliminary units of the course ($p<0.01$) followed by advanced units ($p<0.01$) and core units ($p<0.05$).

DISCUSSION

The statistical evidence on students' entry reported in this study reveals that there has been a growing interest among mature age students to enter into professional courses such as Agriculture, a trend similar to what has been observed within many higher education faculties in Australia as well as overseas (Hore and West, 1980; Maeroff, 1975; West et al., 1986).

The findings of this study show that the mature age students admitted to Diploma course in Agriculture performed as well as, and in some instances better than, their more traditional counterparts. These results are in line with many Australian and overseas studies reporting that older age students are not in anyway lower on the academic scale of performance (Barrett and Powell, 1980; Eaton and West, 1980; Hong, 1982; Mason, 1989).

There was no significant difference between the academic achievement of the two age cohorts as indicated by the overall GPA figures. Also there was no significant difference between the two groups in relation to their performance either in core, preliminary, advanced or more advanced units. However, the distribution of GPA tends to suggest that the mature age students obtained better grades than their traditional counterparts although the difference between the two groups failed to attain any level of statistical significance (see Table 2).

As outlined earlier, a large proportion of the mature age cohort admitted to the course at VCAH - Dookie did not have a formal HSC qualification. However, the academic performance of these students in the Diploma course seems little affected by such deficiencies. These findings are in line with many studies reported in the literature (Anderson, 1973; Eaton and West, 1980; Reed and Murphy, 1975; Wilson and Lapinski, 1978). This would suggest there are factors other than HSC achievement which could decide the student performance at the universities or colleges. The variables such as motivation and maturity (Barrett and Powell, 1980; King and Haynes, 1982); study methods (Hong, 1982; Watkins, 1979); attitudes to university (Hong, 1982; Morgan, 1980) have been reported to have a more obvious direct link with academic performance.

It has often been suggested that students who are highly motivated are likely to fare better in the course than poorly motivated groups (Barrett and Powell, 1980; Boon, 1980). Walker (1975) reports:

> Undergraduates coming directly from school are given little opportunity to consider whether higher education is, for them, a suitable goal, and there is no doubt, that some unwilling or uncommitted students are pressured into higher education by parents or teachers. On the other hand, mature students will probably have spent a period in employment during which weak motivation may not have survived. Taking up full-time study as a mature student can also involve considerable sacrifice and personal difficulties. (Walker, 1975, p. 10).

Compared to traditional entry (to a great extent affected by parent, teacher or peer group pressure) students, the mature age group entered the course in Agriculture of their own accord. It can be argued that these students will be conscientious and hard working in their approaches to their self-selected courses which, normally, would help them along towards their academic success.

One of the most valuable aids many mature age students have is their greater experience of life and the non-academic world. This would allow them to develop a better perception of their study and work which would be beneficial for understanding courses like Agriculture. On an average the mature age students enrolled for the course at Dookie had over three years work experience compared to less than one year for their younger counterparts (Table 6). There is considerable evidence of the benefits of work experience on future studies undertaken by students in many fields of higher education (Barrett and Powell, 1980; King and Haynes, 1982; Knights and McDonald, 1978; Walker, 1975).

Table 6 Work experience (years) by Category of Entry.

Entry	Mean	Standard Error	t-Probability	TOTAL (N)
TE	0.51	0.09	0.000***	75
MAE	3.10	0.48		48

TE: Traditional Entry; MAE: Mature Age Entry: ***p<0.001

Knowledge and skills and more importantly the maturity acquired during the work period are the main assets the mature age students have and the impact of these on education should be that it helps one to do a better job. The mature age students have already something to relate the ideas to while the school leavers have to relate their ideas to future.

People tend to accumulate knowledge and experience, often referred to as "crystallised intelligence" (Cattell, cited by Knox, 1977), due to maturity which would enhance one's ability to perform better in their studies. The maturity of older age students may have been one of the key factors of their success in the study of Agricultural Science reported here. It is suggested that mature age students will devote more time to academic work than younger age students because of greater motivation and perhaps a mature approach to free time outside teaching hours (Walker, 1975). From the data presented here it is evident that mature age students in the Agricultural course can perform as well as, or slightly better in some cases than the younger ones, it is possible that maturity due to age (not the age per se) is a keen factor of their success. This finding is somewhat contradictory to those studies (Astin, 1975; Kapur, 1972) which indicated that younger students tended to obtain higher and better grades. Miller (1970) suggested that any superior academic performance of younger students is not so much a function of age as of intelligence and according to him students who enter university earlier than their peers are most likely of superior ability.

Of the independent variables; age on entry (AGEN), work experience (WEXP), interview score (INTS) and exemptions (EXEM), the interview score (INTS) was found to be the best predictor of academic success in Agricultural Science students. The lack of relationship between INTS and other predictor variables emphasises the value of the interview score as an independent and unique predictor of academic success of these students.

As outlined elsewhere, the INTS was comprised of the students' background information and evaluation of the students' ability for undertaking a particular course. The interview for which the student was required to be present at the College was not conducted as a simple few minutes face-to-face talk between a student and one of the members of staff; rather, it was conducted as an indepth evaluation of students' interest in the particular area of study (Agricultural Science in this case), the reasons for choosing both this particular college and for these studies, secondary school achievement and work experience. Besides this, the interview was meant to record an appreciation of the prospective students' abilities or weaknesses, maturity, personality and social skills. In addition to the interview the students were also required to sit for an elementary Mathematics test to demonstrate their numeracy skills and write a short essay on some specific topic to show some indication of their communication skills.

Evidently, students who score highly at the interview will be more likely to succeed in the course. A student who has attained a higher score may have higher "attributes" to success compared to those who scored only low scores.

As pointed out earlier, the academic achievement depends greatly on the student's effort and motivation. Although motivation of a student to pursue a course of studies is a rather difficult thing to measure, the students' score for the interview can be taken as indicative of this variable and this may explain partly its power in predicting academic success.

The multiple regression analysis has shown that 23 percent of the variance in overall GPA was accounted for by INTS and it appears that the predictive power of this variable was enhanced significantly ($p<0.01$) when measured on student's performance in groups of subjects (see Table 5). The reasons for the differential predictive power of INTS on different subject groups warrants further investigation.

Regarding the effect of AGEN on GPA, this finding is somewhat contrary to that of another Australian study (Hong, 1982) which showed that of different variables studied (namely study methods, TES (Tertiary Entrance Score), personal problems, satisfaction with the college, self-concept, locus of control, flexibility of thinking and age of students) age was found to be the best predictor of academic performance in Behavioural Science students. Compared to the findings in the literature showing the positive atrributes of WEXP and EXEM on student's academic performance (Barrett and Powell, 1980; King and Haynes, 1982; Knights and McDonald, 1978) the nonsignificant relations of these varibles with the GPA, as observed in this study, could partly be attributed to the heterogeneity involved in assessing the nature and duration of work experience and the types of exemptions or credits granted, not to mention the unevenness of the sample size.

CONCLUSIONS

The findings from this study reinforce the conclusions drawn by similar studies on the academic performance of mature age students both in Australia (Barrett and Powell, 1980; Boon, 1980; Hore and West, 1980 and West et al.,1986) as well as overseas countries (Mason, 1989; Reed and Murphy, 1975) that the mature age students do at least as well in higher education courses compared to their more traditional counterparts. The results of the study reported here confirm the same general view and more specifically their satisfactory performance in a professional course such as Agriculture. Material presented here does indicate that there are good reasons for encouraging mature age entry to other professional courses.

The academic performance of the students in the Diploma Course in Agriculture seems little affected by the students' age or their past academic achievement (e.g., pass in HSC). Knowledge and skills and more importantly the maturity acquired during work or otherwise before the commencement of the Course appeared to be the main catalysts of student success. It must be stressed, however, the study did not show any significant direct relationship between work experience (WEXP) and student achievement.

This study has identified some of the student variables which seem to be related to student success in colleges and universities. Among the variables studied, the interview scores of the students appeared to be a strong predictor of academic success of students enrolled in Agricultural course which compare favourably with the ACER-AI/AQ Tests employed, for example, in students admitted to Teacher Education Courses (see Childs, 1974).

RECOMMENDATIONS

In Australia, the need for expansion of the higher education sector has been emphasised by the Governments' *Higher Education Policy Statement*. The Governments' commitments to increase student numbers in higher education has placed enormous pressure on tertiary institutions to find ways and means of increasing enrolments. Presently this has become an issue for survival for institutions whose enrolments by school leavers are declining particularly in faculties like Agriculture, Arts, Humanities and Social Sciences.

In view of the results of the present study, one way of achieving the increase in student numbers, particularly in agriculture courses may be by capitalizing on the increased demand for these courses by mature age students. Such an approach is also in line with the recognition by the Governments' educational policy of the importance of lifelong education, and in particular, the need for further education and training during people's working life. The Government believes:

> Apart from the projected strong growth in the size of the population aged 25 years and over, the proportion of this age group who have completed Year 12 and experienced some form of post-secondary education will increase. There will, therefore, be a larger pool of people who appreciate the benefits of higher education, many of whom will seek to re-enter the system during their working lives. (Dawkins, 1988, p.16).

The success of any college or university course depends upon the academic achievement of students completing these courses. The findings of this study show that the mature age students perform very well, if not better than students straight from school in agriculture courses despite their very varied schooling or work backgrounds. The college administrators could approach the issue of mature age entry as a means of combating the falling student numbers in these courses without the fear of any compromise being made with respect to the academic standard of courses.

This study has identified the need to investigate and analyse the mature age students' "recipe" for success in higher education with the intention of developing some of these aspects for inclusion in all student selections.

The contribution the mature age students make both inside and outside classrooms while they are present at any institution needs to be recognised. The institutions must recognize the need for developing ways and means by which the institutions and younger students could make use of the mature age students' "crystallised intelligence" (Cattell, cited by Knox, 1977) for the betterment of higher education in this country.

Finally and more importantly, this study has identified the interview score of the students as a potential variable to identify students who are likely to succeed in professional courses like Agriculture and further research on this aspect may prove beneficial not only in agricultural studies but in other professional course areas. It would be worth studying the factors which determine the vocational success of graduates and examining whether these are detectable at the time of entry to higher education. The desirability of developing the interview scores in line with other tests, for example, the ACER AI/AQ Test, as a means of identifying potential students for professional courses is once again highlighted by this study. The predictive factors may prove useful on practical grounds, even if these factors have no causal significance.

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AWARD RESTRUCTURING AND ARTICULATED ENGINEERING EDUCATION

By

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SUMMARY

This paper discusses the current state of Award Restructuring and its effect on engineering education and outlines the role the Institution of Engineers should play to monitor the quality of the training provided. The response of the TAFE and Higher Education sector is discussed and a model for the future is predicted.

AWARD RESTRUCTURING

If Australia wants to compete in today's sophisticated international market, we should produce quality goods and services and should develop a competitive edge over other countries. So far the cost of labour and the inefficiency in the production process due to demarcation has been a major contribution to the total high cost of products.

Award restructuring is about removing the barriers to achieving a smarter Australia. It is about the restructuring of industrial award classifications so that outdated, rigid and overly complex classifications which limit workers to narrowly defined jobs can be overcome.

Metals and Engineering industries have taken the lead in this and over 350 job classifications gave way to broad classifications based on just 14 skill levels (Appendix 1). The Commonwealth Government, employers and the unions are the major players in the process of award restructuring. The spinoff to the employee is more opportunity for training and a better career path. A person can enter an occupational area at any classification level and by successfully completing successive courses of training can work up to full professional level. Training has become part of the award. Unions involvement in training has intensified.

Award restructuring is expected to restructure rigid and overly complex award classifications, encourage skills development, making it possible for workers to become broadly skilled, introduce better forms of work organisation and encourage cooperation. As a consequence the demands on the training authorities are to work with industry to provide the training, be flexible about the time and place of training, provide for multiple entry and exit points, provide appropriate education and training at all levels, make provision for people with literacy or numeracy problems, make provision for people from non English speaking backgrounds, provide training that is nationally recognised, provide modular training programs on a competency based system.

The Institution of Engineers

The Metal industry award has a big bearing on the career path, training needs and the training process within the field of engineering. The Institution of Engineers as the body of knowledge in the field of engineers, in the past only concentrated on the professional engineers and the 4 year degree programs. Accreditation by the Institution gave the degree program national and international recognition. This is a

power base for the Institution to exert its influence and maintain its status as a leader and an overseer of the profession.

With award restructuring training becoming more and more an award matter unions and employer bodies are beginning to exert more influence in the training aspects. Career path development based on continuously acquiring further skills meant articulation from one skill level to another. Institution of Engineers could not afford to any further limit their attention to 4 year degree programs. It has become essential for them to look downwards. Articulation and credit transfer from one level of course to another will be demanded in the future. If the Institution of Engineers fails to exert some influence and control in the engineering industry as a whole and exert some control over the engineering education at a level lower than the professional engineer, there is the danger of the Institution becoming an irrelevant body in the future.

It was encouraging to see the Institution, having been passive and reactive in the past, has become active in recent years and has taken the lead and played a proactive role. The Institution has opened up the membership to engineering technologists and engineering associates and formed two societies within the Institution to accommodate these two grades of membership. The educational qualification needed for engineering associate membership is a two year Associate Diploma. An engineering technologist should have a three year qualification. It could be a diploma or degree. We will find in the future universities providing 3 year Bachelor of Technology courses and the TAFE colleges providing 3 year Diploma in Engineering. It will be also possible for graduates from 3 year programs from discipline related to engineering attain the membership of technologist if they are working in the field of engineering.

This change in the regulations wasn't easily won among the membership. Professional engineers always felt that the term "Engineer" was used very loosely in the community and down graded their rightful position as a prestigious profession. They felt accommodating para professionals into the Institution will add to the image problem. It is to the credit of the majority of the membership for recognising the changing environment in which we live in and the necessity for the Institution to change with it.

Education of Engineering Associates in the Future

The Commonwealth is funding a national project to develop courses for engineering associates as part of the metal trades award restructuring. Over the last two years a national project concentrated on developing

material for trade courses related to the metal trades industry. These trade courses are competency based and modular in structure. The same trend is carrying on into the associate diploma development. This is to facilitate articulation and a flexible mode of delivery. A standard module is in the order of 40 hours duration and an associate diploma is expected to be made out of about thirty modules. TAFE teachers are managing this project but the direction is driven very much by employer organisations and the unions. By bringing training into the industrial arena the training agendas are not necessarily set by the training experts. As regards articulation upward into the Bachelor of Technology or Engineering Degree program the project is working in a vacuum. There is no participation in this project either from the Institution of Engineers or the Higher Education sector.

The Institution of Engineers in their publication *'The Institution Towards 2000'* states " The Institution intends to play an active role in the current thrust to make Australians *'work smarter'* and to achieve restructuring in the engineering industry. This restructuring requires provision for definition of skills levels for the grades of professional engineer, engineering technologist and engineers associate and for the provision of opportunity for transfer ("articulation") between levels."

The Institution of Engineers sees the engineering workforce and associate qualification as follows: (Institution of Engineers report on *'The Institution Towards 2000'*, 1990)

> PROFESSIONAL ENGINEER (Four years' full time or equivalent tertiary qualification): applies advanced knowledge and skills in analysis, science, technology and engineering, management and social responsibility, to problem solving and synthesis in new and existing fields in research, development, advanced design, systems, manufacturing and field engineering and, with further formation, to specialist practice or supervision and management.
>
> ENGINEERING TECHNOLOGIST (Three years' full time or equivalent tertiary qualification): applies knowledge and skills in analysis, scientific and technological principles, management and social responsibility, to new and existing technologies in standard design, testing, inspection, plant operation, manufacturing or field work and, with further formation, supervises and manages such work.
>
> ENGINEERING ASSOCIATE (Associate Diploma): as a technical or design drafting officer, applies practical techniques of analysis and technical principles, standards and practices and human

relations, to new and existing technologies in standard design, testing, inspection, plant operation, manufacturing of field work, and with further formation, supervises and manages such work.

TECHNICIAN (Advanced Certificate): applies technical principles, practices, techniques and human relations skills, to activities which include for example: high level manual skills, fault diagnosis and related tasks, in a workshop, laboratory, office, field or operations function and, with further formation, supervise such activities.

TRADESPERSON (OR EQUIVALENT) (Certificate): applies theory, practice and human relations skills to the practical activities of a trade or an equivalent occupation in a workshop, laboratory, field or operations function, and, with further formation, supervises such activities.

If the Institution is to continue to be responsible for the maintenance of professional engineering standards it will need to take two radical steps:

. to extend membership to other key members of the engineering workforce as a means of recognising their acquisition of a standard of education appropriate to the position held, and

. to satisfy itself that credit granted is appropriate, thereby ensuring that the standards of technological knowledge set for the various membership grades are maintained.

The Institution is in the process of achieving the first step but has not done enough as regards the second step.

The Institution sees the future of articulated education in engineering as shown in Fig 1:

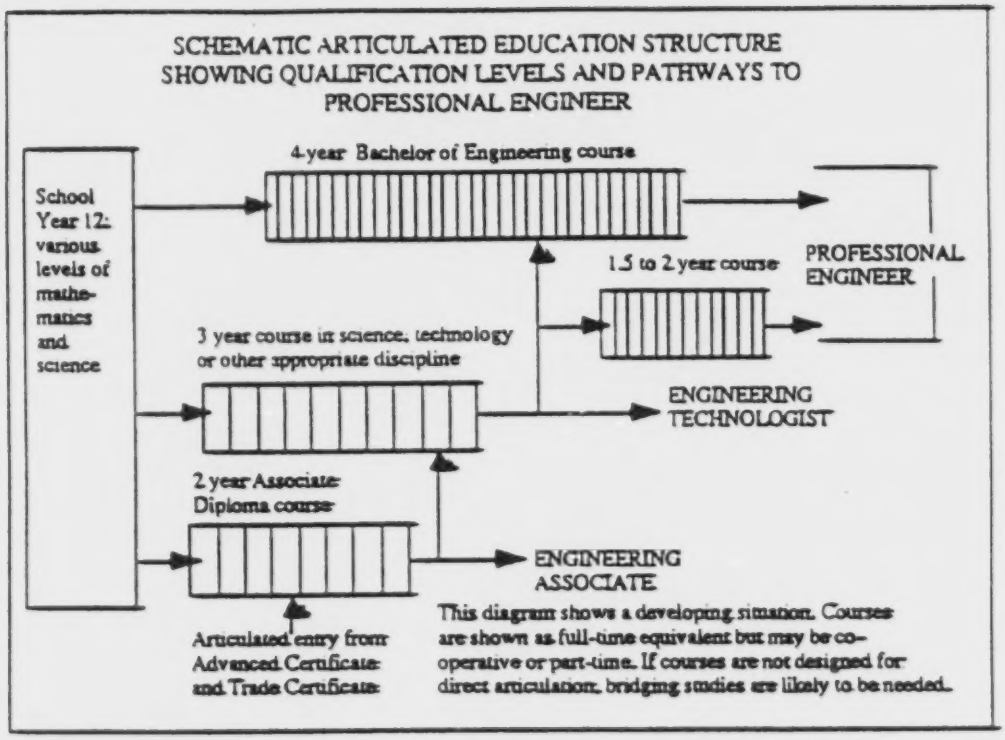
SCHEMATIC ARTICULATED EDUCATION STRUCTURE
SHOWING QUALIFICATION LEVELS AND PATHWAYS TO
PROFESSIONAL ENGINEER
School Year 12: various levels of mathematics and science
4-year Bachelor of Engineering course
1.5 to 2 year course
PROFESSIONAL ENGINEER
3 year course in science, technology or other appropriate discipline
ENGINEERING TECHNOLOGIST
2 year Associate Diploma course
ENGINEERING ASSOCIATE
Articulated entry from Advanced Certificate and Trade Certificate
This diagram shows a developing situation. Courses are shown as full-time equivalent but may be co-operative or part-time. If courses are not designed for direct articulation, bridging studies are likely to be needed.

Fig 1

(The Institution of Engineers report on "The Institution Towards 2000", 1990)

Reaction of TAFE and the Higher Education Sectors

As mentioned before the TAFE sector is currently helping industry and the unions in a TAFE Engineering Technician and Engineering Associate National Curriculum project. With the threat of more private providers entering the training market TAFE is keen to expand its coverage. TAFE intend to cover the technologist category by offering a Diploma in Engineering at TAFE Colleges. Such development has already started in Victoria. I believe TAFE has the support of the Metal and Engineering Workers Union in this matter. The Higher Education sector is keen to get more share of the training dollar and so is mounting Bachelor of Technology courses. The Institution of Engineers is publicly silent with regard to its preference in this matter. However according to the Institution any approved three year course will be acceptable for membership as a technologist.

The Technician and Engineering Associate National Curriculum project hopes to achieve a National Curriculum for Advanced Certificate and

Associate Diploma in Engineering. The articulation from Certificate to Advanced Certificate and to Associate Diploma will be one of their prime considerations. At present, they hope to introduce such a curriculum in 1993 although I suspect it will take longer than planned. It is regrettable there is only limited amount of discussion between higher education and TAFE. The higher education sector does not seem to have a genuine interest in the TAFE sector. It is the old story of "you tell me what you've got and I will tell you what articulation you can have". The thrust of the Commonwealth Government is not received in the spirit it demands. In the future I believe credit transfer and articulation will become the right of the student and the students are going to demand it. If the teaching institutions want to reduce government interference it is time they woke up and took heed of the message.

Model for the Future

I believe the future model for articulated engineering education will take the form as shown in Fig 2.

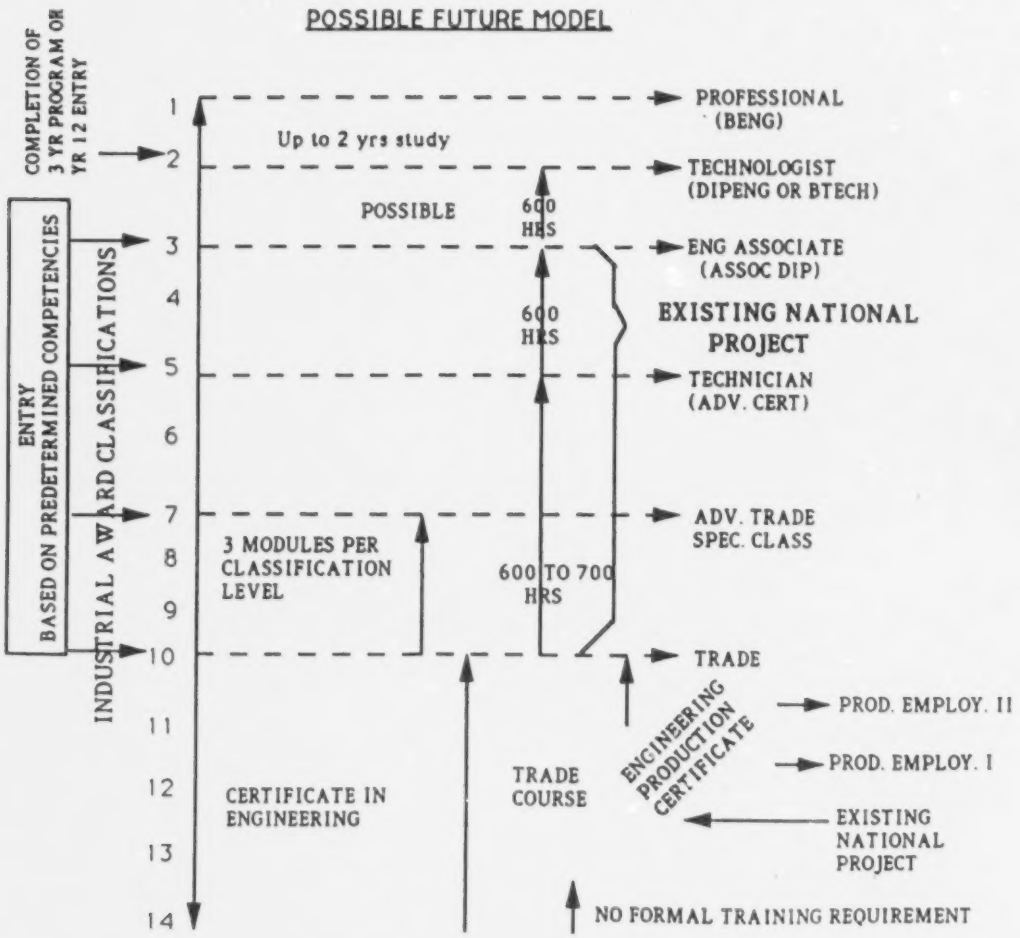

FIG 2

Some aspects of the model for noting are as follows:

a) **Entry requirement** - The model should be flexible enough to cater for multi level entry. In the future the sources of student will be varied. It will be better to define the required competencies at each level and check the applicant for those competencies instead of defining formal qualifications.

b) **Articulating from Trade Certificate to Upper Level** - There is a gap as regards mathematical and scientific skills to be filled before students from trade certificates can progress further towards associate diplomas. This has to be overcome by bridging units which will make the duration longer.

c) **Articulation from Associate Diploma to Bachelor Degree Programs** - The credit received should be in such a way that the duration of the degree program should be reduced by at least a year or two. It is not good enough for the Associate Diploma to receive credit transfer at random in the Bachelor program without any net reduction in the duration of the program.

d) **Broadening of Skills** - Possibilities should be created for broadening of skills rather than acute specialisation. This could result in less risk inbuilt in to the engineering project. The Institution of Engineers in their publication *'Are you at Risk?'* states fragmentation of engineering courses as a cause for increased risks the engineering profession face at present. (See Fig 3)

An engineering project generally consists of more than one discipline of engineering. More compartmentalised is the engineering education less will be the understanding of each other's discipline and the element of risk will be higher.

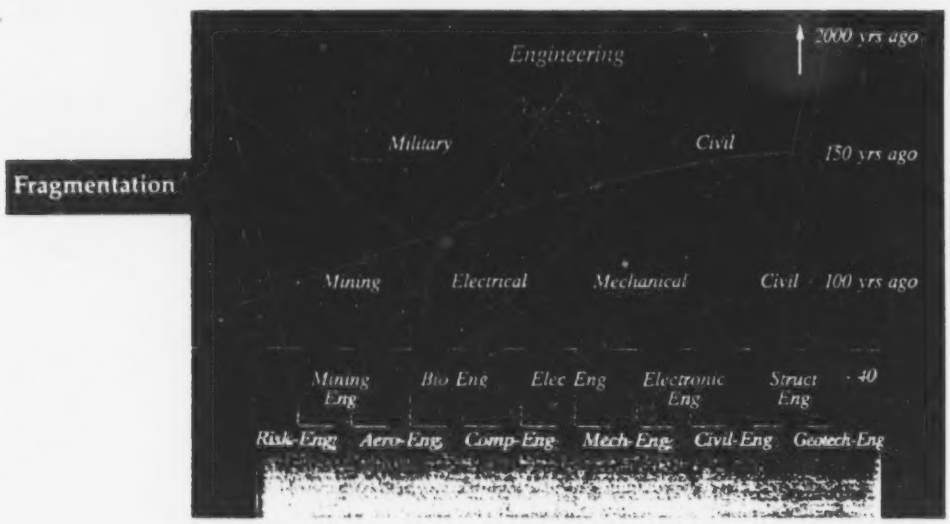

Fig 3

The Institution of Engineers Report on "Are You at Risk", 1990)

CONCLUSION

Articulated education process is part of the award restructuring going on at present. To the educators it is a challenge they should grasp at without delay. In the future it will be a right of the student and the students are going to demand it.

Training has become an industrial issue. There is a danger of non-experts such as unions and employers' officials will drive the agenda which may compromise the quality.

The professional bodies such as The Institution of Engineers which has a genuine interest in education and training for education and training sake should take more interest in education as a whole rather than concentrating on bachelor degree programs.

The interaction between TAFE and Higher Education at present with regard to articulation is at less than desirable level. There is a need for attitude change in the Higher Education sector. If it is necessary bachelor degree programs should be restructured to facilitate articulation.

In the future models for articulated engineering education there should be:

Multi level entry and exit points.
Credit transfer should result in actual reduction of program time.

There should be provision to fill the gap existing in mathematics and science skills at trade certificate level to progress up to associate diploma level.

Broadening of skills to better understand the different disciplines to be encouraged.

APPENDIX 1

(NSW TAFE Authority Report on Training Restructure, 1990)

METAL INDUSTRY AWARD - AN OUTLINE OF THE NEW CLASSIFICATION STRUCTURE

WAGE GROUP	CLASSIFICATION TITLE	MINIMUM TRAINING REQUIREMENT
C1(b)	Professional Engineer Level IV Professional Scientist Level IV	4 year Degree 3 year Degree/Diploma or 4 year Degree
C1(a)	Professional Engineer Level III Professional Scientist Level III	4 year Degree 3 year Degree/Diploma or 4 year Degree or Formal Equivalent
C2(b)	Principal Technical Officer Experienced Engineer Level II Experienced Scientist Level II	Diploma or Formal Equivalent 4 year Degree 3 year Degree/Diploma or 4 year Degree
C2(a)	Leading Technical Officer Principal Engineer Supervisor/ Trainer/Co-ordinator	Completed 5th year of Diploma or Formal Equivalent
C3	Engineering Associate Level II	Associate Diploma or Formal Equivalent
C4	Engineering Associate Level I	Completed 3rd year Associate Diploma or Formal Equivalent
C5	Engineering Technician Level V Advanced Engineering Tradesperson Level II Graduate Engineer Level I Graduate Scientist Level I	Advanced Certificate or Formal Equivalent Advanced Certificate or Formal Equivalent 4 year Degree 4 year Degree
C6	Graduate/Diplomate Scientist Level I Engineering Technician Level IV Advanced Engineering Tradesperson Level I	3 year Degree/Diploma Completed 1st year of Advanced Certificate or Formal Equivalent Completed 1st year of Advanced Certificate or Formal Equivalent
C7	Engineering Technician Level III Engineering Tradesperson Special Class Level II	Post Trade Certificate or Formal Equivalent Post Trade Certificate or Formal Equivalent
C8	Engineering Technician Level II Engineering Tradesperson Special Class Level I	Completion of 66% of Qualification for C7 Completion of 66% of Qualification for C7
C9	Engineering Technician Level I Engineering Tradesperson Level II	Completion of 33% of Qualification for C7 Completion of 33% of Qualification for C7
C10	Engineering Tradesperson Level I Production System Employee	Trade Certificate Engineering Production Certificate III or Formal Equivalent of Trade Certificate
C11	Engineering/Production Employee Level IV	Engineering Production Certificate II or Equivalent
C12	Engineering/Production Employee Level III	Engineering Production Certificate I or Equivalent
C13	Engineering/Production Employee Level II	Up to 3 months in House Training
C14	Engineering/Production Employee Level I	Up to 38 hours Induction Training

Adapted from Figure on page 32, *Consultation, Training and Award Flexibility: Guidelines for Employers in the Metal and Engineering Industry*. Metal Trades Industry Association of Australia. Canberra. June, 1990.

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SPACE PLANNING AND UTILISATION IN TERTIARY EDUCATION

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ABSTRACT

Dawkins initiated higher education revolution in Australia has not only induced major organizational changes through institutional amalgamation but has also strengthened rational resource planning and management. The relative funding model and the imminent release of a space allocation model by DEET are examples of such future directions. The formulation of space planning model for the Unified National System of Australian higher education in turn induces a need at the institutional level to develop appropriate decision support systems for the allocation of capital resources to academic organizational units in addition to the establishment of appropriate mechanisms for the monitoring and evaluation of use of existing spaces (utilization studies). This study reveals that space planning models can be constructed with built-in space utilization standards so as to not only permit more optimal space usage but also to provide a vehicle for the planning of the acquisition of additional building spaces and the relative priorities for the same across academic (and indeed non-academic) organisational units.

1. INTRODUCTION

Australia is moving towards a more rational basis for the planning and allocation of higher education capital resources. In this environment, it is important to analyse and develop various space utilisation and management techniques which can prove useful for purposes of capital planning in tertiary education.

In 1989, the Department of Employment, Education and Training (DEET), the Australasian Vice Chancellor's Committee, Australian Committee of Directors and Principals and the National Board of Employment, Education and Training established a joint working party to develop an information management system for Space Planning and Management in Higher Education. DEET (1990) summarises the purpose of this system as follows:

* To facilitate institutions to maintain and analyse data relating to space management and planning for educational and support area needs.

* To provide DEET with additional information to develop a comprehensive picture of the type and quality of space within the higher education system and in assessing individual capital bids.

The aims of this paper are to examine the development of a space planning model in the Australian context and, to provide an overview of space management in overseas tertiary education institutions.

2. SPACE UTILISATION AND ALLOCATION IN OVERSEAS TERTIARY INSTITUTIONS

2.1 The United States

Much of the development work of space utilisation and space allocation in higher education was initiated in the United States (US). Doige (1974) notes that the first space utilisation studies dated back to 1916 in America when the University of Iowa reported that it could manage only 35 - 50 per cent utilisation.

Fundamental to the development of rational space management techniques is the maintenance of a detailed up-to-date space inventory. This seems to be accepted by many American Universities and Colleges which hold fairly comprehensive space inventories as an adjunct to physical planning. Agro (1978) suggests that the existence of an adequate space management information system in the US may also be due to the initiatives of the US Office of Education which conducts surveys on institutional physical facilities through the HEGIS program.

The existence of a comprehensive and compatible data base in the US has generated inter-college exchange of space information. These inter-institutional comparisons have in turn provided a basis for the development of space standards relating space to programs. In its wider usage, space standards as applied by the American space managers refer to the following three parameters:

(a) The unit area assignment per student station.

(b) Room period utilisation which represents the percentage of hours each week a room is used in proportion to the total academic week.

(c) Student station utilisation which indicates the proportion of seats occupied when a room is in use.

A comparative space study by the University of the State of New York (undated) indicates a certain degree of uniformity in space standards across American tertiary institutions. This is evident from the following comparisons of standards for room availability (in hours per week) and percentage occupancy (prescribed student-station utilization) for selected room types operative in the states of Illinois, Indiana and Iowa (Table 2.1):

Table 2.1

Space Utilization Standards and Factors

	Illinois		Indiana		Iowa	
ROOM TYPE	hr/wk	%occ.	hr/wk	%occ.	hr/wk	%occ.
Class room	30	60	30	50	30	60
Laboratories						
- Agriculture	20-24	80	)20	)75	20	80
- Engineering	20-40	80	)	)	20	80

Some US higher education institutions, particularly those in the state university system, utilize space standards on a formula basis to allocate institutional space resources (Agro, 1978). This begs a good question: what space allocation techniques are used in the US higher educational systems?

According to Wood (1970), the oldest and most elementary approach "was to ask the Dean of a college or Head of a department to estimate how much additional space would be needed for a certain increase in the number of students". This method gave answers which were "obviously in error on the high side".

A second "old method" is a statistical approach which is based on the number of assignable area per student needed for various room types. This method is subject to error too since it tends to perpetuate past errors and inefficiencies (Wood, 1970).

A more "modern" approach called the Drexel method was subsequently developed. It is a time-tabling system which firstly establishes the number of classes, frequency of meeting, and length of each meeting and then creates hypothetical room schedules. The major limitation in this technique is that it does not provide the educational administrator with a space allocation model but a simple centralized time-tabling procedure.

Another method for projecting physical facilities which was developed at the University of Illinios by Bareither and Schillinger (1969) is the "Numeric Method". This space allocation model is more sophisticated and of greater utility than the previously discussed techniques for physical facilities planning.

The Numeric Method can be adequately illustrated by considering an example of one category of space, namely, classrooms. For example, suppose a hypothetical subject Education 1 with an enrolment of 100 students requires classroom attendance for 3 hours per week, then this generates 3 x 100 = 300 weekly student contact hours. Further, assume the following space standards for classrooms:

* Square metres per station = 1.5
* Hours per week classrooms are used = 30.0
* % of time each station is occupied when the classroom is in use = 60.0

Then the area required per weekly student contact hour is 1.5/(30 x 0.60) and hence the total area required as a result of enrolments in Education 1 is 300 x 0.0833 = 25 square metres. Such calculations can be performed and aggregated for all subjects offered by a teaching department to generate that academic units requirement for teaching space. A basic limitation of this method is that it does not specify the number and size of classrooms that should be allocated to the teaching department.

The US has undoubtedly been in the fore-front in the development of space utilization and physical facilities planning models for tertiary education institutions. It will become evident in the subsequent consideration of building space planning models in the United Kingdom and Australia, that educational administrators in these countries have tended to adapt and build on the pioneering studies commenced in the United States.

2.2 The United Kingdom

Grace Kenny (1977) indicates that the impetus for space utilization studies in higher education in the United Kingdom began to gain momentum during the middle to the late 1960's when the universities and colleges came "under considerable pressure to accommodate the result of the post-war baby boom". Musgrove (1974) believes that this concern with space management in Britain grew to prominence in 1967 when the committee of Vice-Chancellors and Principals commissioned a space utilization study. This study showed very low utilization levels and a large variation in standards of operation at the 47 universities surveyed.

In the United Kingdom, the Department of Education has sponsored space utilization studies as a means to enhance effective management of institutional accommodation. Further, Rawlinson (1977) states that the UK Department of Education has been encouraging tertiary institutions to undertake their own utilization studies so that their proposals for new buildings can be supported by factual data. This poses the question: how is the actual institutional space requirement determined in the United kingdom?

The Department of Education and Science Design Note 8 (1972) details the space allocation "model" used to calculate gross floor areas required for the expansion of physical facilities in Polytechnics. The model for determining space requirements for Polytechnics is a simple one; it assumes that space allocation is a function of types of courses, numbers of students and space standards stated as an area allowance per full time equivalent student. This approach is, therefore, very similar to one of the "old methods" of space allocation utilized in the US, as discussed in the previous section.

Thus much work has been undertaken in the UK on aspects of space utilization in higher education. The British studies have largely been directed at increasing utilization of existing teaching space and not towards the development of more effective models for space allocation within institutions; only macro-models have been developed to enhance inter-institutional resource allocation with very limited capability for intra-institutional space allocation.

It is contended that this emphasis on space utilization may be mis-directed since, a particular academic unit's under-utilized capacity could be due to declining enrolments rather than inefficient classroom scheduling. In this regard, space managers can be guided by the more balanced approach provided by the US specialist in the field to the two important dimensions of tertiary education accommodation planning.

3. SPACE MANAGEMENT IN AUSTRALIAN COLLEGES

Sharma (1982) undertook a survey of resource management in the former Australian Colleges of Advanced Education. The following summarizes the salient results of the data analysis from that study on space planning.

Firstly, the analysis of the survey questionnaire indicated that between 1978 and 1979 approximately 59 per cent of the responding colleges experienced diminished capital funding, 27 per cent were in a stationary state and only 14 per cent enjoyed a real increment in their budgets for building projects. VPSEC (1991) study indicates a highly constrained resource situation in 1991 with "...an additional $320 million would need to have been invested in 1991 (in the state of Victoria) to accommodate actual enrolments in that year"; it is hence evident that a shortfall in higher education capital funds has continued in Australia.

Sharma's study though dated, was undertaken at a time of highly constrained capital funding for Australian Colleges which is similar to the current situation. Despite this fact only five percent of the respondents utilized a rational approach to the allocation of teaching space. Nevertheless, many respondents have developed sound management principles and procedures to promote efficient utilization of existing institutional spaces. In fact, some institutions had made such progress that they were on the threshold of developing mathematical models to achieve a better internal allocation of spaces.

Table 3.1 indicates the degree of progress achieved by the former CAEs in the effective administration of institutional accommodation. The data shows that 82 per cent of the respondents annually review space requirements for their college. In times of severe shortages, such a regular assessment of the total accommodation needs of institutions become essential for survival. For instance, a variation in student composition over time could demand the re-adjustment between building space types. Further, such a review would assist colleges in the preparation of submissions to external authorities for additional funds for building projectss.

Table 3.1

Space Management in Australian Colleges

	Percentage of Respondents
Annually Review Space Needs	82
Maintain a Space Inventory	86
Regularly Monitor Space Utilization	70
Centralized Time Tabling	
- of all teaching space	50
- for lecture space only	17
- other teaching spaces	29

Since 1978, the then the Tertiary Education Commission began an annual collection of space inventory information from Australian Colleges. Therefore, it was not surprising that 86 per cent of respondents maintain a space inventory. However, it seems that the stationary state funding situation prevailing at the time had induced many colleges to monitor and increase the utilization levels of their building spaces. For example, 70 per cent of responding colleges had engaged in a regular monitoring of institutional space utilization whilst 96 per cent employed some form of centralized time-tabling system for teaching spaces. The significance of a time-tabling system is that one of its major aims is "to improve utilization of general teaching spaces" (Rawlinson, 1977). In addition to the implementation of a time-tabling system for teaching spaces, the respondents indicated the employment of the following management control devices in an attempt to increase the overall utilization of the building spaces:

(a) Increasing after hours space usage.

(b) Annual review of space utilisation.

(c) Promoting off-campus studies.

(d) Analysing request for specialist space in terms of the department's utilization of existing space and rejecting requests where low usage of similar facilities exist.

(e) Retaining central control of general purpose teaching spaces.

(f) Spreading classes as evenly as possible throughout the week.

(g) Consolidating of small classes.

(h) Encouraging students to use under-utilized teaching spaces for private study during times when the rooms are vacant.

(i) Encouraging extra-curricula community activities on campus.

(j) Spreading load to evening sessions for part-time students.

(k) Conversion of specialized space which is under-utilized to other space types which are in demand.

Since only a small proportion of respondents utilized a rational approach to the allocation of college building space, it would be informative at this juncture to consider some of the correlates of colleges' accommodation. In addition to collecting data on staff and student statistics, Sharma's survey questionnaire sought the net assignable instructional area (in square metres) from each college. Table 3.2 specifies the Pearsonian Coefficient between net institutional spaces and such variables as student enrolments and staffing for responding colleges.

According to this tabulation, the net instructional area is strongly correlated with Equivalent Full Time Student (EFTS - where full time students count as one and part-timers as a half) Enrolment ($r = 0.84$); it is even more closely associated with the total academic staffing of the colleges ($r = 0.87$). However, in view of the association between these three variables it is necessary to test, by the application of multivariate statistical analysis, whether a spurious element exists in the correlation matrix. Computation of Partial Correlation Coefficients indicate that the correlation between net instructional area and academic staffing is true. The correlation between net teaching area and student enrolments is, however, spurious.

Table 3.2

Correlates of Net building Space (m^2) in CAEs

Building Space	r^2	r	N
Instructional Area			
- & EFTS Enrolment (int)	.699	.836	12
- & Academic Staffing	.749	.866	12

Although further research appears to be necessary to investigate the problem of "multicollinearity" between these variables, the Pearsonian and Partial Correlation Coefficients between student enrolment (x), staffing numbers (y) and institutional building space (z) suggest that the empirical model of association is probably x -> y -> z.

More recently, Lagunzad (1990) has indicated that "the available (Australian) literature on facilities utilization measurement is relatively sparse". There is a need for greater institutional research efforts in Australia within the field of tertiary education space planning and management. Lagunzad has shown that the space planning techniques developed in the higher education sector are equally applicable to the TAFE sector (the AAIR which represents interests across the whole spectrum of Australian tertiary education be it TAFE, polytechnics, colleges or universities will try to fill the gap of this area of institutional research). Clearly, institutional researchers within the Australasian region need to make greater efforts in not only undertaking developmental efforts in the area of space planning and management but also disseminate the results of their investigation through paper presentation and publication. The Lagunzad study further suggests that Sharma's study is of contemporary interest to tertiary education resource planners.

4. DEVELOPMENT OF MODELS FOR THE ALLOCATION OF TEACHING SPACE RESOURCES

The empirical study of Australian colleges revealed a general lack of utilization of comprehensive analytical techniques for planning instituutional resource allocation (Sharma, 1982). Similarly, the study of resource management techniques used in overseas tertiary education organizations, revealed some methodological flaws; for example, the models utilized in these institutions were often disjointed and lacked adequate integration. Even DEET's space planning and management system appears to be heading in the direction of a highly aggregated macro model which will simply allow a certain assignable area per equivalent full-time student units by discipline. Whilst such a model should prove useful in establishing inter-institutional priorities for space allocation within the Unified National System of Australia's higher education, it is unlikely to be suitable for intra-institutional building resource planning. The present section aims to traverse these problems, by developing a more comprehensive physical facilities resource allocation model in respect of teaching units.

In addition to clearly indicating the inter-relationships between pertinent variables, the resource allocation model should exhibit the following characteristics:

(a) The model should be simple, resulting in broadband grants to teaching departments/faculties. This is dictated by the need to devolve decision-making to the lower levels of the organisation.

(b) The model should be based on statistics which are accurate and valid in terms of indicating comparative demands for resources. Since a primary function of higher education is to provide tuition to students, the class contact hour would be a fundamental measure of resource demand; space related to other missions such as research would need to be identified separately.

(c) The model should take cognizance of as many of the real variables of the teaching process as possible.

(d) The model should incorporate a feed back process which will permit assessment of the efficient utilization of resources and promote accountability to the tax-payer; in actuality this is not a characteristic that can be designed into a mathematical model, but is really a part of the management information system of the institution.

College students and staff require adequate accommodation in order to participate in academic activities. The large capital investment by the public in providing the requisite site and buildings necessitates a sound basis for establishing the demand for institutional space and its efficient utilization. This section describes such space projection models which integrate with student forecasting techniques as part of a comprehensive institutional decision support system.

As indicated earlier, one of the most sophisticated space allocation technique constructed and utilized in overseas institutions is Bareither and Schillinger's "Numeric Method". To achieve a more generalized statement of the techniques and its effective integration with a possible student projection model developed by the institution, the Numeric Method is re-formulated as follows:

Let the number of weekly student contact hours generated by enrolments in subject i be $WSCH_i$ and denote the pertinent space standard for the programme by s_i (m^2 per station), hours per week the room is used by H and the percentage occupancy of the station when the room is utilized by O; then the total usable floor area required to teach all subjects offered by the department is given by

$$A = \sum_i \frac{10^2 WSCH_i S_i}{H O} \qquad \text{..... 3.1}$$

The Numeric Method of teaching space allocation has several limitations which diminish its utility. Firstly, the technique does not explicitly provide for the differing spatial requirements for the variety of teaching modes use in tertiary education. Further, academic activities often demand ancillary functions which are not considered in the above model; for instance, chemical laboratories require additional space for the storage of equipment and consumable material. Anderson and Hoadley (1973) recognizing these problems effected appropriate refinements to the model; it will be useful at this juncture to consider this revised Numeric Method. Denoting the parameters as follows:

P_m = Percentage of total departmental weekly student contact hours taught in space type m
a_m = ancillary space factor for space type m
s_m = space standard (m^2 per station) for space type m
H = total hours per week the room is available
f = percentage of room periods utilized (frequency factor)

then the total net area required by the academic unit of space type m is specified by:

$$A_m = \sum_i \frac{10^2 \left(WSCH_i \right) p_m a_m s_m}{H \; f \; O} \quad \ldots\ldots \quad 3.2$$

The above models promote efficient usage of building space by incorporating assumed utilization levels.

Although the Anderson and Hoadley model provides significant improvements over the Numeric Method of space allocation, it has certain constraints. Firstly, the technique assumes that the percentage of teaching carried out in a particular space type is stable from one year to the next and can, therefore be estimated from historical data. In practice this room loading factor is likely to vary with changes in curriculum and teaching mode employed by the functional unit. Further, both the Numeric Method and its above variant do not output the actual physical facility required in terms of number of rooms of certain capacities. These difficulties are surmounted in the space allocation system developed below (Sharma, 1982).

As indicated earlier, any resource allocation technique should recognize that the number of teaching groups is not continuous but integral. Thus, denoting the enrolments in subject i by SE_i, optimum class size for teaching model m by cm and weekly prescribed contact hours for subject i under teaching mode m by wpmi, then the number of m type instructional rooms of size cm required is specified by[1]

$$N_m = \frac{10^4}{H \; f \; O} \sum_i \left(\frac{SE_i}{cm} \right) wpmi \quad \ldots\ldots \quad 3.3$$

In general N_m will not be a natural number but will have an integer component, I plus a fractional component d, that is,

$$N_m = I + d \quad \ldots\ldots \quad 3.4$$

Therefore, the institution is faced with the following practical alternatives: either (a) allocate (I + 1) rooms of type m to the teaching unit, or (b) allocate I rooms of space type m to the functional group and permit it to share its fractional requirement d with other units which have the requisite under-utilized capacity. The net total area of space type m allocated to the academic unit is given by

$$Am = N_m p_m a_m s_m \; /100 \quad \ldots\ldots \quad 3.5$$

where a_m and s_m have the same physical meaning as in equation 3.2 above. Algorithms 3.3 and 3.5 together with a student load planning model represent an integrated model for allocating building space to the teaching units in order to permit them to execute their necessary academic programmes.

1 This of course assumes that rooms corresponding to the optimal class size will be provided despite the fact that actual class size may fluctuate about this figure in accordance with subject enrolments.

It is contended that the above room/space allocation model overcomes some of the problems inherent in the Numeric Method and its variant. However, the former model has certain limitations which need to be counteracted. The basic problem with the technique developed here stems from the fact that the weekly prescribed contact hours wp_i for each subject generally represents staff/student contact time only. Therefore the room/space allocation system developed above does not make any provision for non-timetabled [2] student load. This difficulty, however, can be surmounted by including the non-timetable contact hours in the Subject Master File, as separate and distinct figures from the actual staff/student contact data; equations 3.3 and 3.5 may then be applied to this information to output the space requirement generated by non-timetable student load.

The above model development specifies the timetabled and non-timetabled teaching spaces requirements of academic units. However, in practice the organisational units make other demands for building spaces including higher degree, staff research and staff accommodation. These matters are considered below.

Higher degree research students require space equivalent to the staff offices (in addition to learning spaces identified above); in general, what is required is a private study carrel for students. In some cases, such stations are provided in a central library but in others, the academic organisational unit needs to provide the required area within its own space allocation. Space standards for this facility tend to vary but my experience at RMIT indicates that 5.5 metres per EFTSU would appear satisfactory.

In practice, academic organisational units have a research mission in addition to teaching. Such space needs to be planned on some rational basis. A method using either area per higher degree research student or per academic staff member could prove useful. For instance, when I was working at RMIT, it was assumed that approximately half the full-time academic staff will be active in research and an area allowance of 10 square metres per active staff member was made for purposes of personal applied research or staff development activities.

Staff accommodation also needs to be provided for academic organisational units. Most academic staff office planning models use a student/staff ratio model to estimate projected needs for equivalent full-time academic staff and other staff requirements for teaching units. An area allowance per staff member is then used to quantify the staff accommodation requirements of the academic organisational unit. Most such models are variable in nature, that is, they assume that the staff accommodation area is directly proportional to full-time equivalent staff. However, the RMIT model has both a fixed and a variable component to it. It provides a fixed area of 35 square metres per academic organisational units for purposes of provision of reception area and the like for the teaching unit and as associated with the establishment of the office of the Head of Department. It is further noted that the RMIT staff accommodation model provides 3 square metres per full-time equivalent staff for purposes of ancillary spaces (such as required to house staff equipment and storage requirements).

2 This arises in situations where students are required to undertake essentially non-supervised activities in addition to normal staff/student contact hours. For instance, students may require computation rooms to complete assignments or projects.

In non-academic organisational units, the space needs arise from essentially staff related activities including office requirements, associated storage space and area required to house office equipment. Staff accommodation can be estimated in a similar manner to that described above for academic staff. Storage and equipment requirements can best be established by interviewing the head of management units and making a satisfactory provision for such activities. Ground rules can be developed for the latter, for example, at one tertiary institution a standard three square metres was permitted for each personal computer station in an office.

5. CONCLUSION

Recent environmental pressures facing Australian Higher Education will mean increased need to plan the allocation of building spaces more effectively as well as, carefully monitor the utilisation of existing spaces. With the advent of the DEET Space Planning and Management Statistical Collection, there is increased accountability by institutions to the Federal Government on building space resources. In recent times the growth in student load in Australia has increased much more rapidly than the available spaces in tertiary institutions. This together with the over-enrolment situation in most higher education institutions in 1991 means that greater pressure will be exerted on the existing building space available to institutions.

The DEET Space Planning and Management Model (SPAM) will only provide a macro decision support system - one which is applicable only at a broad level and for purposes of inter-institutional comparisons. However, such a model is not comprehensive enough to guide space allocation within a particular institution. For instance, it is unlikely to output the usable floor area required for staff and accommodation, research, teaching spaces by type, non-timetable spaces and ancillary space for each academic organisational unit. Therefore, institutions will need to develop a more comprehensive model for the allocation of building spaces to the academic and administrative organisational units. The work undertaken in such decision support systems in the United States and at RMIT will provide significance guidance in this matter. Further, model refinements made in this paper should also be of assistance in particular, permitting institutions to convert area requirements into the number of physical rooms required for teaching and research purposes.

Future investigation of space planning models include empirical studies to establish space standards for the research mission of higher education, demands for non-timetable spaces and studies which assist in further refining decision support systems for the allocation of non-academic space. Given the diversity of research efforts by members of the Unified National System and the advent of DEET's SPAM efforts, there is an urgent need to investigate space requirements associated with higher education research. Such research should be undertaken as a matter of priority so that the proposed DEET space allocation model can be discussed with adequate rationality.

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PLANNING AND TOTAL QUALITY MANAGEMENT

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1. Introduction

A plan, in its very basic form, means a scheme for accomplishing a purpose by a proposed method or a scheme drawn before hand. Universities in Australia, and overseas, have been involved in some form of planning for a considerable period of time. Much of the recent thrust in this area has been in response to the need to establish educational profiles, as instituted in Dawkin's White Paper of 1988. Successful planning requires measures of parameters of interest and clear objectives. Principles of Total Quality Management (TQM) and Quality Function Deployment (QFD) can assist in developing objectives and measures. Furthermore, resource and strategic planning areas which require focusing can also be identified.

2. Purpose of a University

It is proposed that the main function and, hence, the mission of a university today can be broadly sub–divided into three main categories:

- As custodians of knowledge, which has been accumulated by people over the centuries. Knowledge by its very nature is cumulative. The university staff add to this knowledge by research (pure and applied) and scholarship;
- Training people to become technicians, practitioners, scholars, researchers and worthy citizens;
- Transfer technology and knowledge through staff and students to industry, business and community for the benefit of the individuals, companies and society at large.

Having established a mission for the universities, the senior staff need a vision of what they want their organizations to look like in 10 to 20 years. Furthermore, there is a need for a means to achieve this mission.

3. Total Quality Management and Quality Function Deployment

More and more companies in Japan, United States and Europe are working towards transforming themselves into more efficient and competitive organizations. This is being achieved through the fourteen points of TQM (Deming – 1982) which can be summarised as follows:

- Create constancy of purpose towards improvement of product and service
- Management must awaken to the challenge of change and accept leadership
- Build quality into the product at the design stage
- End the practice of awarding business on the basis of price tag alone
- Improve constantly and forever the system of production and service
- Institute training on the job
- Institute leadership and supervision practices
- Drive out fear, so that everyone may work effectively for the company
- Break–down barriers between departments/sections/units
- The bulk of the causes of low productivity belongs to the system and, thus, lies beyond the power of the work force
- Eliminate management by objectives
- Remove barriers that rob people's pride of workmanship
- Institute a vigorous program of education and self–improvement
- The transformation to the new philosophy is everybody's job

QFD was first introduced by Akao in Japan in 1965 (Mizuno and Akao – 1978), and is basically a methodology for translating a vision into measurable objectives and strategies. More recently King has adapted this approach to western work practices (King – 1989). Fundamentally, QFD consists of a number of Techniques which can be easily applied in manufacturing, service and other industries. These techniques can be summarised as follows:

- Affinity Charts
- Inter–relation Digraph
- Tree Diagrams
- Arrow Diagrams
- Matrix Charts
- Matrix Data Analysis
- Fault Tree Analysis
- Process Decision Program Chart
- Matrix of Matrices

QFD approaches planning in a phased fashion:

- Organisation
- Description
- Breakthrough
- Implementation
- Analysis

4. <u>What is the Present Situation of Universities Today</u>?

One of the major difficulties faced by universities today is that our total operation has become more complex. Some of these complexities arise because

of market forces, many are self-generated while others are unnecessarily enforced upon us by State and Federal Governments. Some would argue that many of these complexities do not 'add value' to the final 'goods and services' when you examine these from the client's perspective.

Some of these complexities can be summarised as follows:

- Higher Education Contribution Scheme (HECS)
- Issues of Equity
- Education Profiles
- Over-Enrolments
- Over-Crowding
- Lack of Resources
- Full-Fee Paying Overseas Students
- Safety Issues
- Industrial Issues
- Shortage of Well-Qualified Staff in Some Areas
- Salary Parities with Industry
- Student Issues
- Lack of Training of Staff at Various Levels

Other complexities arise because of flaws in the system. Many of these complexities are major features of today's operating environment which needs attention. These complexities could be interpreted as demands for more services. Some of these complexities are:

- Errors leading to Rework
- Variability
- More Process Steps than Necessary
- Over-Kill on Accountability
- Lack of Delegation

Traditionally, however, we are not very good at reducing complexities. We tackle problems by introducing additional layers of management. We try and manage complexity. This is fundamentally different from Deming's philosophy (Deming–1982). Our approach is to classify jobs on the amount of complexity managed. Performance on the job is rated on how well an individual is perceived to manage complexity. As a result of all this, we end up rewarding wrong behaviours.

5. What Needs to Be Done?

We need to reduce complexity by finding and eliminating flaws in our systems. It can be correctly argued that TQM in its present form is not applicable to education. It is worth remembering that the number of students attending universities because of extrinsic interest is increasing. With the introduction of Higher Education Contribution Scheme (HECS) and Full–Fee Paying Students (FFPS) education is regrettably becoming more commercialised. Hence, a greater need for more efficient planning and operation of universities.

Another fundamental tenet of TQM is that we all work in a system and when things go wrong it is the system that is at fault for 85 per cent of the time. The worker can be blamed 15 per cent of the time. This is known as the 85/15 rule (Juran – 1988). Therefore, through proper planning and system designs, we can improve the operations of universities. Basically, we have to revise our processes to reduce complexity, errors and variability. Staff training and participation are important ingredients for the long term well–being of an organisation.

6. Difficulties with Some of the Present Management Approaches

We need a university–wide system that gets everybody in the university working for the benefit of students, staff and the community. We have difficulty in achieving such an objective, largely due to our emphasis on top/down management styles of governance. Such styles are couched in terms of managers and not 'customers' and 'workers'. This approach has the following difficulties:

- Lack of consensus on mission and vision of the university – which, usually, leads to lack of ownership – by staff at the lower end.
- Focus is often on the production of a plan. Little or no attention is paid to the way of achieving the plan.
- Multiple and, at times, conflicting objectives between upper and lower echelons of management.
- Processes for setting and achieving objectives are not commonly understood in the universities.
- Reviews of Processes, Departments and Branches are often just the listing of accomplishments and not an analysis of causes of deviation between what was planned and what was achieved.
- Lack of horizontal mapping of objectives across Faculties, Departments and Branches.
- No, or little, similarity in prioritizing of university functions relating to services to the students.

Many of the above difficulties arise because of our reward and recognition systems which, for academics anyway is largely based on research output.

7. How QFD Can Help?

QFD can be regarded as a component of TQM which helps an organisation to plan and execute strategic organisational breakthrough. The QFD process can be broken down as follows:

(a) Steps:

- Establish university mission and vision. (Keep it simple and brief).
- Develop three to five year objectives (in some cases you may need one to two years to focus on processes which require urgent attention).
- Deployment/Roll Down to Faculties/Departments/Branches to develop plans.
- Implementation.
- Review.

(b) Key Elements:

- Client Focus
- Environmental Factors (economic, industry, State and Federal)
- Closing the gap between reality and vision
- Achievements in some areas, as against plans for all and achievements in none
- Responsibilities clearly defined
- Co–ordination of plans across Faculties/Departments/Branches
- Reasons for change well–explained
- Staff at all levels get right messages
- Emphasis on self–diagnosis of individuals and systems
- Build in recognition and support, not punishment
- Problems viewed as opportunities to be discussed
- Accurate Data (external and internal). No fudging of figures

- Use of appropriate measures
- Reduce variation
- Build in Plan, Do, Check, Act (PDCA) cycle for continuous improvement of processes
- Analyze results even if plans have been successful. Analyze what leads to achievement.
- Review QFD itself

(c) Tools:

For successful implementation of planning training of staff is an essential ingredient. Training would include the use of a number of TQM tools including some of the following:

- Market Research
- Performance Reports and Analysis
- The Seven Statistical Tools of TQM
- Data Collection and Analysis
- Brainstorming

8. Summary

Universities in all their activities are required to handle a vast array of issues. Everything is getting more complex. Principles of TQM and QFD can help simplify processes and produce team spirit. We should look for causes and remedies to reduce variation and waste.

Planning through QFD is a system which can help universities set and achieve major breakthroughs. QFD has been successfully used in manufacturing and service industries and is consistent with the management principles developed by Dr Deming through TQM.

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COMPUTERIZED ENROLMENT AND TIMETABLING AT THE UNIVERSITY OF SYDNEY

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1. Introduction

The University of Sydney changed to semesters from terms in 1989. In many parts of the University this was seen to present difficulties. The change to semesters was really only a catalyst which exposed a number of existing problems. These problems included difficulties of space allocation for classes, timetabling of new courses and the allocation of students to classes.

The University made two decisions at this time. It was decided to computerise the allocation of general teaching areas & to form a timetable committee with representatives from each of the faculties for coordinating timetable changes which resulted from the change to semesters.

This committee met on three occasions and responsibility to oversee the timetable changes was passed to a timetable co-ordinator. After the start of lectures in 1989 a report on all the difficulties, together with some suggested solutions, was prepared. This report was endorsed by the Academic Board with a recommendation that a University Timetable Co-ordinator be appointed.

The main initiatives of the timetable co-ordinator have been in the areas of room allocation, enrolments and student timetable allocation. This paper outlines the current arrangements and concludes with some comments on likely future developments.

2. Room allocation

The software which has been developed for allocating rooms to classes has grown directly out of the traditional method used when room allocations were kept on a file of room cards.

The software maintains, in addition to room bookings, information about the audio-visual needs, sizes and room preferences of classes as well as the audio-visual facilities, sizes and other characteristics of rooms.

Bookings can be made manually or by an automatic allocation procedure. In the case of the automatically allocated bookings the machine will match a class to a room using the information about size, audio-visual facilities and preferences.

In addition to semester bookings there is a facility for making casual bookings - that is bookings at a specific time on a single day at any time of the year. This facility also includes details of any charges and payments. When checking for clashing bookings, account is taken of public holidays and semester breaks.

Apart from confirmation & cancellation letters the machine can produce a number of forms of output including detailed lists and statistical data. Output may be directed either to the screen or a printer. In the case of the casual bookings reports on the payments of room charges can be obtained.

Bookings are not carried forward from one year to the next but there are procedures for carrying the information forward so as to minimise the need for operator input.

3. Enrolments

Until 1990 all enrolments (other than in the Faculty of Engineering) at the University of Sydney were in hard copy form and were later keyed into the central records computer. Enrolment checks were made by faculty advisers & later by faculty offices. The problem was that there was too long a delay between enrolments and computerised access to the information. Checking of enrolments was unreliable and often by the time errors were found it was too late to correct them.

In 1990 five faculties participated in a system which has become known as *PC enrolments*. At the time of enrolment the student selects the courses and these are keyed into a PC (IBM or Macintosh) by the faculty adviser. The computer performs a range of status checks such as prerequisites and corequisites requirements for courses. When the student and adviser have agreed on the enrolment the new enrolment is recorded. At the end of the day the information is collected and passed electronically to Student Records and the timetable allocation system.

The advantage of using PC machines is that they are cheap - usually borrowed for the time of enrolments - and if one machine breaks down then the others continue to operate. Since the machines are not networked there is the disadvantage that it may not be possible to immediately recover details of an enrolment.

In 1991 all of the original five faculties again used PC enrolments and one other faculty devised a similar system of its own. Over 12500 students were enrolled in this way in 1991. At the time of writing PC enrolments are possibly to be extended to three more faculties and an amalgamated institution for 1992. The same system is being extended to deal with changes of enrolment.

The enrolment status checks are determined by human readable files which are maintained by the faculties. Here is a sample of part of the Japanese entry in the course data file:

Course J2A1 'Japanese IIA(1)' Code '23905' Units 0.5 Group 12 Exclusive OJ2A Prereq J1A Advise coreq J2A2W;

In 1991 students were also able to change their enrolments using the PC operation whilst enrolments continued. This operation is not entirely satisfactory at the time of writing (because of the inability of the advisers to recover existing enrolments) but the results were exceptionally good. The process resulted in a considerable reduction in enrolment changes, after the close of the enrolment period.

In 1991 most of the data was available to Student Records a few hours after the close of enrolments. Students receive, by post, details of their enrolment from Student Records whenever an enrolment is initiated or changed on the student record system.

After collection the numbers of students enrolled in the various courses were made available to Faculties and Departments. This enabled planning of staffing of the courses and the resolution of

problems arising from enrolments which differed significantly from predictions. It was also possible to produce class lists.

In the Faculty of Arts a pre-enrolment exercise was tried. The success will result in the extension of pre-enrolment. Students were asked to indicate the courses into which they planned to enrol in the following year. Those who did had the information keyed into the computer and after the examination results had been processed status checks were performed. For a student who satisfied the status checks the enrolment was confirmed by entering the student identification number and pressing one further key. For students for whom the status checks had failed, the detailed information about the failure appeared on the screen and the pre-enrolment could be adjusted to a valid enrolment. It turned out that students who had pre-enrolled could be processed more quickly than other students.

It is likely that pre-enrolment will be developed to enable students to complete enrolments without the need to present themselves on campus.

4. Student allocation to classes

For courses with alternate classes it is a time consuming task to manually allocate students to lecture, tutorial and practical sessions. On the other hand such allocation is essential since there are insufficient resources for students to choose their own times.

A computerised operation has a number of advantages. First of all it is possible to simultaneously allocate students to all, or most of

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	Monday	Tuesday	Wednesday	Thursday	Friday
8					
9		Chemistry 1A Lecture Chemistry Theatre 3	Mathematics 1 Pure Tut (from Wk 2) Carslaw Lect Rm 6B	Chemistry 1A Lecture Chemistry Theatre 3	
10	Physics 1 Lecture Physics Lec Rm 1	Mathematics 1 Applied Tutorial Madsen Room B61	Physics 1 Lecture Physics Lec Rm 1		Physics 1 Lecture Physics Lec Rm 1
11	Mathematics 1 Pure Lecture Wallace Theatre	Mathematics 1 Applied Lecture Carslaw Theatre 4	Mathematics 1 Pure Lecture Wallace Theatre	Mathematics 1 Applied Lecture Chemistry Theatre 1	Mathematics 1 Pure Lecture Wallace Theatre
12	Computer Science 1 Lecture (A) Series 2 Carslaw Theatre 4	Computer Science 1 Lecture (B) Series 2 Stephen Roberts Th.	Chemistry 1A Lecture Chemistry Theatre 3	Computer Science 1 Lecture (C) Series 2 Carslaw Theatre 5	
1					Computer Science 1 Challenge Lecture Carslaw Theatre 4
2			Chemistry 1A Practical Chemistry School	Computer Science 1 Workshop/Tutorial Madsen Room LG41	Physics 1 Practical Carslaw Lab 7
3			Chemistry 1A Practical Chemistry School	Computer Science 1 Workshop/Tutorial Madsen Room LG41	Physics 1 Practical Carslaw Lab 7
4			Chemistry 1A Practical Chemistry School	Computer Science 1 Workshop/Tutorial Carslaw Lect Rm 6A	Physics 1 Practical Carslaw Lab 7
5					
6					
7					

Enrolled courses:

Mathematics 1
Physics 1
Chemistry 1A
Computer Science 1

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Please check the above timetable carefully. If the subjects on it are wrong, or if the times clash with any other subjects in which you are enrolled, then you must complete an "Application for New or Changed Personal Timetable" form and take it to Carslaw Lecture Room 3B.

Fri Jun 21 13:43

their classes. This avoids the difficulties encountered when the allocation for one course becomes incompatible with that for another course. Secondly it enables a better distribution of students to classes (sometimes even reducing the number of classes which need to be held). Finally a well organised computer allocation program can perform the task exceedingly quickly.

The software used at Sydney University for allocation of students to first year courses in the generalist faculties runs on a small UNIX workstation. At the present time it can allocate about 6000 students in about 2 minutes. Printing the resulting timetables takes twelve and a half hours and handing out is carried out over three days. (Changes to suit individual student needs are included in the handout operation).

Individual student timetables (a sample of which is included in this paper), are printed and handed out to students before the start of classes.

The data for the timetable allocation procedure comes from enrolments and files which contain detailed information about classes and rooms. Here is a sample:

{Agricultural Economics I Contact: Phone: Building Code:A04}

COURSE AGEC1 'Agric Economics I' CODE '12359' SELECTED

FIXTURE AGEC1.L 'Lecture' MAX 160 IN UNK AT MWF11

PART AGEC1.T 'Tutorial'

CLASS AGEC1.T.T10 MAX 18 IN WATT106 AT T10

CLASS AGEC1.T.T11 MAX 18 IN WATT106 AT T11

CLASS AGEC1.T.T12 MAX 18 IN WATT106 AT T12

CLASS AGEC1.T.W12 MAX 18 IN WATT106 AT W12

CLASS AGEC1.T.W1 MAX 18 IN WATT106 AT W1;

This means that the course Agricultural Economics I has a compulsory lecture on Monday, Wednesday and Friday at 11am. In addition each student must be allocated to one of the 5 one hour tutorials held in the room Watt 106 at the times indicated.

At the end of the timetable operation there will be available a list of the students in each of the classes as well as a total student list giving for each student the classes to which that student has been allocated for this course.

Certain other reports are produced by the allocation process. The most important of these is the report showing how many students have been allocated to each class.

Some courses are only partially timetabled or have the timetable included only so as to ensure that no clashes appear with that course and courses which are being allocated.

In the case of students with a timetable clash, which the computer cannot resolve, a blank timetable is produced (with the word *CLASH* printed over the page). These students are allocated when they come to collect their timetable. They may be advised to change their enrolment.

The purpose of the allocation process is to evenly fill the classes.when there are alternatives. If classes are over or under-filled by a significant margin then warning messages appear. It is

possible to prevent the machine from overfilling a class under certain circumstances. However this procedure may result in students being given a blank timetable.

The usual procedure is for trial allocations to be made and the numbers of classes to be adjusted to suit the enrolment. Only after this procedure has been completed are the final allocations made and the individual student timetables printed. Even after this time extra students and, in some circumstances, classes can be added.

An important aspect of this operation is the possibility of a second chance to improve the allocation. Since students are allocated sequentially by the machine, it may be that some classes are artificially full because at an early stage in the allocation procedure students were allocated to a class, which later was overfilled, when an alternative would have been acceptable. A second run may be used to reallocate such students. This is the reason for not handing timetables to students when they enrol.

Changes to suit individual student needs can be made to a student timetables. Thus it may be possible to keep an afternoon free if the student has some other commitment at that time. When a student asks for a change then all class allocations may change. Some requests cannot be satisfied. A common request is that two students be allocated to the same classes. To satisfy this kind of request is incompatible with the overall aim of equal relative filling classes.

The following is a portion of a report giving details students who are enrolled in a combination of courses for which no non clashing timetable can be produced:

2 Clash in compulsories: SOCTH2.L clashes with GSM.L at W10

1 No solution found: 'Arabic IB' 'Fine Arts I' 'French IB' 'Soc Anthropology I'

This report is particularly valuable for designing new timetables. (The number at the left of each line is the number of students involved.)

5. Collection and dissemination of information

The data from enrolments is collected on floppy disks from the PC machines in faculty enrolment areas. It is checked and processed on another PC machine. The checks at this point include checks on the integrity of the data and checks on enrolment changes.

The data is then passed electronically to student records and to the timetable allocation database. Computer files which enable the production of class lists are passed to faculties and departments.

Information about the student allocations to classes are given to departments by electronic mail, on disk or in hard copy according to departmental wishes.

6. Concluding Remarks.

The operation which has evolved over the past few years at the University of Sydney is very efficient. It has been designed to make optimal use of both machine and human resources.

Status checks performed at enrolment have resulted in greater reliability of the initial enrolment data with fewer changes. This in turn has led to a faster and more efficient allocation of classes to rooms and timetables to students.

Initial reluctance of some parts of the University towards some of the initiatives has now been overcome and there is considerable enthusiasm for extensions of the system.

Problems however remain. Overcrowding of classes at the University continues. This is not the result of inefficient timetabling but because students choose to ignore the classes to which they have been allocated and attend alternative lecture streams. In small classes this can be policed and so is not a serious problem. In large classes policing is not a feasible option. In order to address some of these issues, the student allocation system is being used to design new timetables.

Finally there is the question of an integrated system, rather than a system which is perceived to be fragmented. The "fragmented system" has some advantages. Not the least of these is that it is less rigid and cheaper than a totally integrated system. The hardware used for enrolments and class allocation is normally used for teaching purposes at other times of the year.

THE PLANNING AND DEVELOPMENT OF AN INTEGRATED RESEARCH INFORMATION SYSTEM IN A UNIVERSITY

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I. INTRODUCTION

1. The planning and development of new information systems, including the redevelopment of existing information systems in the National University of Singapore is based on a data management approach ie the University-wide data model serves as the foundation for all administrative information systems development work. When the University's data model was first prepared in March 1990, 3 main subject areas were clearly identified, namely Student, Staff and Alumni. It was at this stage that the possibility of a fourth subject area Research was first explored.

2. Up until now, most of the University's data on research has not been computerised with the exception of two information systems setup by the Bursar's Office in the 1980s. One of these systems records the expenditures of outside funded research projects whilst the other system monitors the progress of University funded research projects. There is also a textural database setup by the University Liaison Office for the on-line retrieval of information pertaining to the current research interests of staff members.

3. In the last few years, there has been a rapidly expanding research culture in the University in line with the Singapore nation's vision of having the University play an active role in advancing the frontiers of R&D (Research and Development) in Singapore. This has led to the commissioning of new research institutes within the University as well as the formation of industrial collaboration centres within the various Faculties to help promote and intensify the University's R&D ties with industry. To propagate the spread of research culture, much of these activities have been decentralised to the Faculties and research institutes.

4. More recently, it has been recognised that there is a need for the University to develop some indicators to monitor and measure the research output of the University. Some of the indicators presently used by the University include the number of research publications of staff members and number of funded research projects.

5. Two sources of data have been used to compile statistics on research publications of staff members, namely the publications lists provided by staff members in their curriculum vitae submissions to Personnel Department for the annual staff review and the staff members' submissions to the University Liaison Office for the University's annual publication on Publications and Theses. Since both sources of data are textural, much time and effort is required to code, data capture and edit the data before it can be used to provide meaningful statistics. Furthermore, the presence of the two sources of data on publications of staff members means that the number of research publications reported by the 2 sources will not be incomparable.

6. Considerable effort is presently also required in compiling statistics on number of funded research projects. Since the two information systems implemented in the Bursar's Office are designed primarily for accounting purposes, it can only provide aggregate data on the funds spent on the various funded research projects. For more detailed analysis, additional data will need to be collected, coded and data captured. The additional data will also include information on the unfunded research projects carried out by the Faculties which are not required by the Bursar's Office systems.

7. Arising from this need to design an integrated information system to monitor the research output of the various research activities in the University, the Integrated Research Information system was conceived.

II. OBJECTIVES

8. It was recognised from the start that the Integrated Research Information system will be a University-wide system, designed to meet the needs of the Bursar's Office, Personnel Department, University Liaison Office, Library and the Faculties. The Planning Services Unit which has been assisting the University to compile indicators on research output was made responsible for the coordination of the entire planning and development work. The computerisation aspects of the system are being handled by the Computer Centre.

9. The initial objectives of the project were defined based on the requirements of the University Liaison Office and the Library, and then integrated with the requirements from Bursar's Office and Personnel Department. At about this time, the University was also aware that the Centre for Industrial Collaboration of the Faculty of Science was interested in developing a database on the research profile of the staff members in their Faculty to facilitate industry's access to information on expertise in the various fields. Following from discussions with the Faculty of Science, it was agreed that the Faculty's requirements could be incorporated in the system. It was further agreed that the Faculty would be the pilot site for the Integrated Research Information system. It was also coincidental that the Dean of Faculty of Science had earlier been appointed the Adviser for the project to advise on the academic departments' needs for the system.

Hence, the final list of objectives for the project included the following:

- to promote and facilitate multi-disciplinary research as well as industrial collaboration within and without the University

- to enable the University to identify staff members with particular research interests and thus facilitate matching them with research opportunities

- to enable the University library to identify and disseminate appropriate materials to support faculty research.

III. DATA MODEL OF SYSTEM

10. The data model for the Integrated Research Information system was prepared based on the objectives of the project. This data model provided a schematic representation of the various entities in the system and showed the relationship between the various entities. A schematic diagram of the data model is given in Figure 1.

(Note: Glossary of terms used in Data Modelling

Entity refers to a thing eg Staff, Student, Research Publication, etc

Relationship refers to a logical linkage between two things. This linkage is formulated based on the University's business rules eg a staff member may author many research publications ie the staff member may be the main author or co-author of one or more research publications.)

11. There is an accompanying data dictionary which describes the various entities in the data model. The data dictionary for the Integrated Research Information system was compiled based on inputs from the various departments collaborating on this project. Details of the data dictionary for the Integrated Research Information system is found in Annex 1.

12. The data model and data dictionary provide a basis for a common understanding among the various collaborating departments on how the various entities in the Integrated Research Information system are linked to each other. In particular, it helps the University to establish the linkages between the "data owners" and the "data users". When this link is established, the "data owners" and "data users" gain a better insight into how their data needs are integrated, and this leads to closer collaboration and cooperation efforts among the departments concerned to ensure that data collected by "data owners" are gainfully used by the "data users".

IV OVERVIEW OF VARIOUS APPLICATION SYSTEMS

13. The Integrated Research Information system comprises the computerisation of the following application systems:

Application System	Collaborating departments
Research Publications	Personnel Department University Liaison Office Library Faculties
Research Projects	Bursar's Office Faculties

Staff Consultancy Work	Personnel Department Bursar's Office Faculties
Current Research Interests	Library University Liaison Office Personnel Department Faculties

14. A brief description of the scope of each of these application systems and how these application systems benefit the various collaborating departments is discussed below. A description of the procedures that are being developed or planned will also be discussed, wherever possible. It should however be noted that since these application systems are in various stages of planning and development (the entire Integrated Research Information system project is envisaged to be implemented in phases within the next two years), the procedures at best describe the project's present plans and developments. These procedures are subject to possible changes as the application systems are being developed.

Research Publications

System Objectives

The system will maintain a database of the research publications of the University's staff members. The publications data from this database will be used by the Personnel Department for its annual staff review purposes, as well as used by the University Liaison Office for the compilation of its annual publication on Publications and Theses. Information on staff members' publications history will be made available to the Faculties and Library for on-line enquiry and reporting purposes as well as for publication of Faculties' publications on research publications of staff members.

It should be noted that the Research Publications system will provide a single source of data on staff members' publications, thereby leading to a consistent source of information University-wide. This source of data will also be comprehensive since it is based on information submitted by staff members to Personnel Department in their curriculum vitae for the annual staff review. Up until now, one of the common difficulties encountered by the University Liaison Office in the compilation of the University's annual publication on Publications and Theses is incomplete information since the University's publication on Publications and Theses offers no direct benefit for staff members to provide a complete and up-to-date staff publication list (unlike the publication list provided in the curriculum vitae for the annual staff review purposes). Furthermore, publication lists of staff members who have left or are about to leave the University's employment are frequently not available, thereby leading to a possible understatement of the University's research output in this University publication.

Before the development of this system, the only information available to Faculties on staff publications consisted of hardcopy information compiled yearly for the annual staff review (there are two review sessions per year for different categories of staff members, in May and October respectively), Publications and Theses (compiled as at December of each year) and Faculty publications (which are compiled by some Faculties only). With the implementation of the Research Publications system, Faculties will be able not only to enquire current data on staff publications on-line, but also monitor the research output of their Faculties on a current basis.

The Library presently maintains a hardcopy of all publication papers of staff members. Like the University Liaison Office, this department also encounters difficulty in obtaining an up-todate list of staff publications. The Library has requested for the inclusion of a data item to indicate whether the publication is available in the Library in the Research Publications system. This data item will be maintained by the Library and used by the Library to follow-up currently with Faculties on all outstanding publication papers not yet sent to the Library.

Procedures Developed To-date

A one-time coding, data capture and editing of the publications details of staff members prior to 1990 was carried out by Planning Services Unit based on the textural information in the publication lists which staff members submitted to Personnel Department in their curriculum vitae for the annual staff review. A listing of the computerised publications data has been sent to the staff members for their verification purposes. A sample output of the verification listing (which also lists the data items captured in the system) is enclosed as Annex 2.

During the verification stage, staff members were also required to provide the following additional data items:-

i.	Keywords	-	6 keywords most appropriate for describing the publication work. It is envisaged that these keywords may facilitate retrieval of publication work by current research interest in future. (Note: This item is applicable to all publications except book reviews and editorial work on journals)
ii.	Details on Research Project	-	Items (a) and (b) are applicable to publications which are the output of a Research Project.
a.	Account number of Project	-	This item is applicable to funded research projects only. It refers to the account number assigned to the research project.
b.	Name of Research Project	-	This item refers to the name of the research project.

It should noted that data collected on research projects will facilitate the linkage between research projects and research publications data. Further details of this linkage are discussed under the system objectives for the Research Projects system.

A one-time classification and setup of a master file of the journal titles of all existing journal publications (of staff members) was carried out as part of the coding and editing work. These journal titles have been classified in consultation with Faculties, and this classification is presently used by Personnel Department for its annual staff review purposes.

The Research Publications system has been designed in close consultation with the Library as they have the expertise to advise on the data items required for citing publications. In this connection, the University has adopted the citation style recommended in the Chicago Manual of Style, 13th Edition. Furthermore, the codes used for coding the journal titles of journal publications in the system are based on the call numbers assigned to the serials collections catalogued by the Library. This approach will facilitate future retrieval of journal publications from the Library's serials collections.

When the Research Publications system is implemented, it is intended that the updating of staff publications will be carried out on-line by staff members since the application system will be implemented as a University-wide office automation application on the University's Campus Network. The system is designed such that publications data will be entered by the first-named University author. Where the first-named University author is away (eg on sabbatical leave), procedures will be available for the other authors to enter the publication data (and an electronic notification will be automatically sent to the first-named University author). Data integrity checks (eg Call No/Vol No/Issue/Page No(s) checks, ISBN checks, etc) will also be built into the system to minimise data capture of duplicate research publications.

Research Projects

System Objectives

The system will maintain a database of all research projects (funded and unfunded projects) to facilitate the monitoring of all new and ongoing projects. Besides the funding and expenditure information required by the Bursar's Office, this system will also capture information on the industrial collaboration aspects of the project as well as research projects carried out using existing departmental resources with no additional funding support. The Faculties will be able to use the information in this database to monitor the progress of the Faculties' industrial collaboration efforts (eg number of projects under University-Industry collaboration, etc) as well as the status of the Faculties' multi-disciplinary projects.

Presently, only data on funded research projects is available from the Bursar's Office information systems which were designed primarily to meet the Bursar's Office needs.

In recent years, the University has been actively monitoring the status of Faculties' multi-disciplinary projects. Since the information captured in the Bursar's Office information systems is primarily used for accounting and financial reporting purposes, Faculties need to compile separate hardcopy reports on the status of the Faculties' multi-disciplinary projects (Multi-disciplinary projects refer to research projects which involve collaborations between staff members from different Faculties. These projects may include research projects carried out using existing departmental resources with no additional funding support).

With the implementation of the Research Projects system, a complete database of both funded and unfunded research projects will be available for enquiry and reporting purposes. This will be particularly helpful to Faculties since they need a complete profile of all research activities, including the work carried out on unfunded research projects. The funded research projects can continue to be maintained by the Bursar's Office, whilst the unfunded research projects can be maintained by the Faculties. The additional information pertaining to the industrial collaboration aspects of the research projects will also need to be maintained by the Faculties. With the implementation of the Research Projects system, the current status of multi-disciplinary projects can be retrieved from the database based on information of the Faculties which the collaborating staff members (of the research project) belong to. Current information on the number of collaboration projects between staff members from different Faculties can also be readily made available for monitoring purposes.

Procedures Planned To-date

It is envisaged that this application system will require the one-time classification and setup of a master file of all University-Industry Collaborations (presently, these collaboration agreements are maintained manually by the respective Faculties) and the setup of a Donor master file. The Donor master file will also meet the needs of the University's Alumni Affairs and Development Office and University Liaison Office.

As is the case with the Research Publications system, it is envisaged that the initial database on research projects will be setup based on existing data on funded research projects captured by the Bursar's Office. Reformating, coding and editing work will need to be carried out on the data before it can be made available to Faculties for verification and data capture of the industrial-collaboration aspects of the data. In particular, information on staff members, donors etc will need to be coded as these information are presently captured as textural data in the existing Bursar's Office information system which records expenditures of outside funded research projects.

Current Research Interests

System Objectives

The proposed system will maintain a profile of the current research interests of each staff member. This profile will be used by the University Liaison Office to compile its annual publication on Directory of Current Research as well as generate the current research interest lists provided by staff members in their curriculum vitae submissions to Personnel Department for the annual staff review. It will also be used by the Library to implement the selective dissemination of specific information to individual staff members. It is envisaged that Faculties will find this profile useful as it will enable them to identify staff members with particular research interests and thus facilitate matching them with research opportunities.

As is the case with the publications data, one of the difficulties encountered by the University Liaison Office in the compilation of the University's annual publication on Directory of Current Research is incomplete information since the University publication offers no direct benefit for staff members to provide a complete research profile, thereby leading to a possible understatement of the University's research profile. However, with the integration of the Library's requirements for the selective dissemination of specific information and Personnel Department's requirements for the curriculum vitae submissions, the staff member will have a vested interest in providing a more complete current research interest profile.

Procedures Planned To-date
The Library has suggested that the following two items be used to describe the current research interests of a staff member:-

(a) an identifier item containing free-text words or phrases supplied by staff member; and

(b) a subject item containing headings from the Library of Congress (LC) subject headings.

It is envisaged that the current research interest information on LC subject headings can be matched with data on new Library acquisitions (LC subject headings are presently available for all catalogued books in the Library) available from the Library's Library Integrated Catalogue application system so that the selective dissemination of specific information to individual staff members can then be implemented.

Staff Consultancy Work

System Objectives
This system presently maintains a database of the consultancy work of staff members. Data has been captured in the system since July 1990. The system was initially developed to meet the needs of the Personnel Department and Bursar's Office. It is used by the Personnel Department to monitor the number and type of outside consultancy work carried out staff members. The system is also used by the Bursar's Office to monitor the income earned by staff members from outside consultancy work as it is the University's policy that the income earned by a staff member from his outside consultancy work should not exceed a certain proportion of his gross annual salary.

Procedures Planned To-date
Up until now, the Faculties' requirements for this system have not yet been considered. However, when the consultancy work of staff members is made available to Faculties, it may be possible to establish the link between current research interests and consultancy work so that Faculties can use this information to identify staff members with particular research interests and thus facilitate matching them with opportunities for consultation work. At the present time, it is envisaged that individual information on staff member's consultancy work will only be made available to Deans and Heads of academic departments in the Faculties as this information is personal to staff members.

It is envisaged that there may also be the need to establish a link between the client and donor since the staff member's client for a consultation work may be a donor or grantor for a particular grant research project of the University.

V. IMPLEMENTATION PLAN

15. The entire Integrated Research Information system will be implemented in phases over the next 2 years. A schedule of its implementation plan is outlined in Figure 2. As discussed earlier, the Faculty of Science will be the pilot site for each application system before it is made available University-wide.

VI. CONCLUSION

16. This paper has discussed the framework used for the planning and development of an Integrated Research Information system in the National University of Singapore. Since the data model is used as the basis for the planning and development work, it is possible to identify and establish the linkages between the various entities in the data model before the development of the application systems. This approach is envisaged to improve the timeliness and quality of the data in the application systems being implemented and thus support the overall institutional planning work on research output in the University.

Annex 1:

Data Dictionary for the Integrated Research Information System, National University of Singapore

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i. **Client** refers to an organisation for whom a staff member carries out consultation work approved by the University under the consultation/outside work scheme. The agreement between the staff member and the client regarding the work to be carried out can be verbal or in writing. It is possible that the client is a donor of the University.

ii. **Consultancy** Work refers to the work that is undertaken by a staff member for an outside organisation for which the staff member is paid by that organisation. Approval to undertake the work would have been granted by the University under the consultation/outside work scheme. The type of work may include providing specialist service, conducting in-house training, etc. The staff member undertakes the work in his personal capacity.

iii. **Current Research Interest** refers to the subject interest of the academic staff member. These subject interests make up the University's Faculty research profiles. This information can be used by the Library for the selective dissemination of information. An academic staff member may have many subject interests and a particular subject interest may be shared by many staff members. The subject interests also provide an opportunity to spot any multi-disciplinary research topics and discover research activities in different departments that relate to similar topics, ie multi-disciplinary research in the University.

iv. **Donor** refers to an organisation or an individual who makes an outright donation (which may take the form of money, or other resources eg equipment, staff member, etc.) to the University, without receiving any form of benefit in return.

v. **Invention** refers to a discovery made by staff members or students of the University. The University's Intellectual Property Committee reviews any patentable inventions or copyrightable works which a staff member or student wishes to commercialise. Should the Intellectual Property Committee decide that a patent application be made in respect of an invention, the invention will belong to the University. Proceeds from the commercialisation of any invention are shared between the University and the inventor.

vi. **University-Industry Collaboration** refers to a collaboration between the University and any outside organisation including Government departments, Statutory Boards and the private sector in one or more of the following ways:

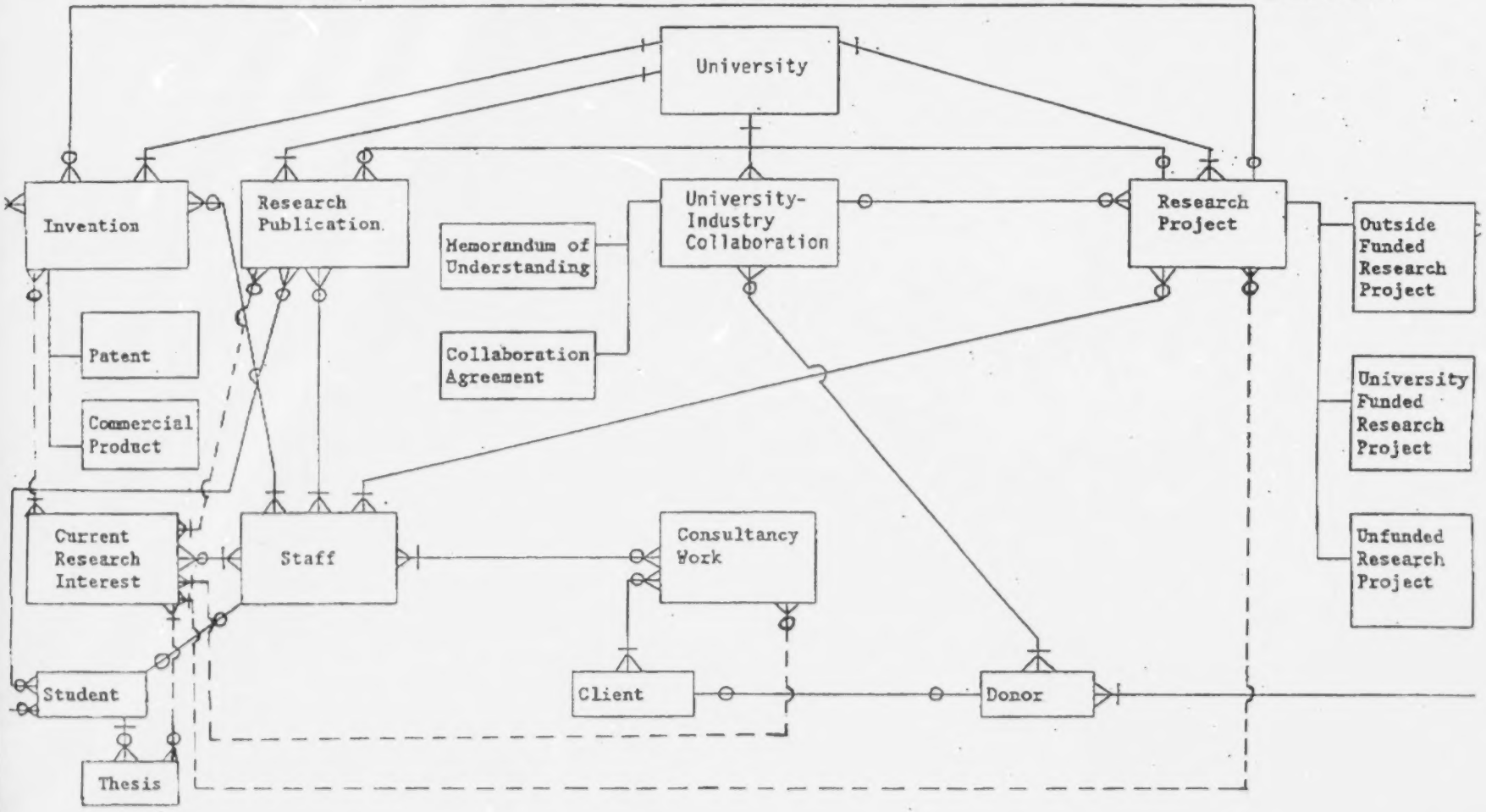
- both parties will agree in the area in which they wish to have collaboration;
- the other party may assign one or more of their staff members as investigators or supervisors of the project; and
- funding for the project may be provided by only one party or jointly by both parties.

ix. **Staff** refers to an employee of the University, whether on contract or on permanent appointment. A staff member can either be a teaching staff member or a non-teaching staff member. Non-teaching staff member include administration, library, research, computer professional and non-academic staff member. In the detailed data model, this entity encompasses information on the staff's personal data, dependent data, medical benefits, training data.

x. **Student** refers to a person who has been admitted to a course of study in the University or has been accepted for candidature for a degree of the University. The person should also have signed the register. Generally, there are three types of students, namely, undergraduates, postgraduates and non-graduating (special) students. Undergraduates refer to students admitted to courses for first degrees, whilst postgraduates refer to students admitted to candidature for higher degrees. As for non-graduating students, they refer to students who are reading courses that are not proceeding to NUS degrees/diplomas. In the detailed data model, this entity encompasses information on the student's personal data, statistical data, financial data, hostel data and medical data.

xi. **Thesis** refers to the research output which a postgraduate student for the Master's degree or degree of Ph.D. (Doctor of Philosophy) submits to the University's Board of Examiners on Higher Degrees for approval. Copies of the thesis, whether approved or not become the property of the University.

FIG.1 : DATA MODEL FOR THE INTEGRATED RESEARCH INFORMATION SYSTEM, NATIONAL UNIVERSITY OF SINGAPORE



Legend on entity relationships :-

One to One	One to Many	Many to Many	Optional (ie entity relationship may not exist)
+—+	+—<	>—<	+—o

(12.8.91)

Annex 2 : Sample output of the verification listing from the Research Publications system
National University of Singapore

PAGE 1 of 4 LISTING I 28 AUG 91 17:56

STAFF : 501999X CHOW KIT BOEY DEPT : BUSINESS POLICY

NO: 1 1. PUBL TYPE : 11 Article in journal 2. PUBL STATUS : 1 Published

3. AUTHORS DETAILS :

a.ORDER	b.LAST NAME	OTHER NAMES(in full)	c.TICK IF STUDENT	d.DEPARTMENT/PLACE OF EMPLOYMENT	e.AUTHORSHIP
01	Chow	Kit Boey	No	Business Policy	_____
02	Lim	Kian Guan	No	Finance and Banking	_____

f. CORPORATE AUTHOR(S) :
_____

4a. TITLE: Small and medium enterprises: the case of Japanese investments in Singapore

5. TITLE OF SOURCE PUBLICATION :
Singapore Management Review

ISSN NO : _____ ISBN NO . _____
10a. VOLUME NO : 11
10b. ISSUE : 2 PART : _____ SEASON : _____
10c. THEME OF SPECIAL ISSUE:
_____
11. PAGE NUMBERS : FROM 29 TO 40
16. DATE OF PUBLICATION : __/__/1989 List all if dates straddle two years or more : ___/___/___ ___/___/___
21. KEYWORDS : _____ _____
_____ _____
_____ _____
22a. ACCOUNT NO OF PROJECT : _____
22b. NAME OF RESEARCH PROJECT:
_____
23. REMARKS : _____

OFFICE USE ONLY : 501999X 002 F

208

209

205

NO 2 1. PUBL TYPE : 21 Conference paper 2. PUBL STATUS : 1 Published

3. AUTHORS DETAILS :

a.ORDER	b.LAST NAME	OTHER NAMES(in full)	c.TICK IF STUDENT	d.DEPARTMENT/PLACE OF EMPLOYMENT	e.AUTHORSHIP
01	Chow	Kit Boey	No	Business Policy	Main author

f. CORPORATE AUTHOR(S) : _____

4a. TITLE: Government-private sector cooperation in APC-HRD: some suggestions

5. TITLE OF SOURCE PUBLICATION :
Proceedings of the International Seminar on Human Resources Development: Concept, Policies, Needs and Cooperation

ISSN NO : _____ ISBN NO : _____

6. EDITOR(S)/COMPILER(S) OF SOURCE PUBLICATION (PLEASE CIRCLE WHICHEVER IS APPLICABLE) :
C Hongladarom

8a. NAME OF CONFERENCE OR SEMINAR/PUBLIC TALK/LECTURE : _____

8b. DATE HELD : FROM __/__/____ TO __/__/____ (day/mth/yr)
8c. LOCATION : _____(VENUE) _____(CITY) _____ (CNTRY)
8d. ORGANISER(S) : _____
8e. SPONSOR(S) : _____
10a. VOLUME NO : _____
10b. ISSUE : _____ PART : _____ SEASON : _____
10c. THEME OF SPECIAL ISSUE: _____

11. PAGE NUMBERS : FROM 85 TO 102
13. PLACE OF PUBLICATION : Bangkok (CITY) Thailand (COUNTRY)
15. PUBLISHER : The Human Resource Institute, Thammasat University, Ministry of Foreign Affairs, Thailand, and the Government of Australia
16. DATE OF PUBLICATION : __/__/1989 List all if dates straddle two years or more : ___/___/___ ___/___/___
21. KEYWORDS : _____ _____
_____ _____
_____ _____

22a. ACCOUNT NO OF PROJECT : _____
22b. NAME OF RESEARCH PROJECT: _____

23. REMARKS _____

OFFICE USE ONLY 501999X 005 F

206

2.1

2.0

NO: 3 1. PUBL TYPE : 31 Book/Monograph (authored) 2. PUBL STATUS : 1 Published

3. AUTHORS DETAILS :

a.ORDER	b.LAST NAME	OTHER NAMES(in full)	c.TICK IF STUDENT	d.DEPARTMENT/PLACE OF EMPLOYMENT	e.AUTHORSHIP
01	Chow	Kit Boey	No	Business Policy	
02	Chew	Moh Leen	No	English Proficiency Unit	
03	Su	E	No	English Proficiency Unit	

f. CORPORATE AUTHOR(S) :

4a. TITLE: One Partnership on Development: UNDP and Singapore

9. EDITION NUMBER :

12. TOTAL NUMBER OF PAGES : 150

13. PLACE OF PUBLICATION : _____ (CITY) Singapore (COUNTRY)

15. PUBLISHER : United Nations Association of Singapore

16. DATE OF PUBLICATION : __/__/1989 List all if dates straddle two years or more : ___/___/___ ___/___/___

21. KEYWORDS :

22a. ACCOUNT NO OF PROJECT :

22b. NAME OF RESEARCH PROJECT:

23. REMARKS :

OFFICE USE ONLY : 501999X 007 F

NO: 4 1. PUBL TYPE : 36 Chapter in book 2. PUBL STATUS : 1 Published

3. AUTHORS DETAILS :

a.ORDER	b.LAST NAME	OTHER NAMES(in full)	c.TICK IF STUDENT	d.DEPARTMENT/PLACE OF EMPLOYMENT	e.AUTHORSHIP
01	Chow	Kit Boey	No	Business Policy	_____
02	Cheong	B C	No	Finance and Banking	_____

f. CORPORATE AUTHOR(S) : _____

4a. TITLE: The Singapore economy: where's it heading ?

5. TITLE OF SOURCE PUBLICATION :
Business Cycles in Five ASEAN Countries, India and Korea (II)

ISSN NO : _____ ISBN NO : _____

6. EDITOR(S) OF SOURCE PUBLICATION :
H Osada and D Hiratsuka

9. EDITION NUMBER : _____
11. PAGE NUMBERS : FROM 247 TO 255
13. PLACE OF PUBLICATION : Tokyo (CITY) Japan (COUNTRY)
15. PUBLISHER : Institute of Developing Economies
16. DATE OF PUBLICATION : __/__/1989 List all if dates straddle two years or more : ___/___/___ ___/___/___
21. KEYWORDS : _____ _____
_____ _____
_____ _____

22a. ACCOUNT NO OF PROJECT : _____
22b. NAME OF RESEARCH PROJECT:
_____

23. REMARKS : _____

OFFICE USE ONLY : 501999X 009 F

VERIFIED BY : _____ (SIGNATURE) DATE : ____/____/____

- Background -
THE AUSTRALASIAN ASSOCIATION FOR INSTITUTIONAL RESEARCH (AAIR)

The Association for Institutional Research (AIR) originated in the United States of America some 30 years ago. It now commands an international membership of over 2,000. The Australasian AIR is affiliated with AIR and was conceived in 1988 following discussions between Dr John Muffo, the Secretary of AIR and Dr Raj Sharma - then the Executive Assistant (Directorate) at the Capricornia Institute of Technology. They believed the time was right to establishe an Australasian Association since management support staff within most tertiary education institutions is involved in institutional research, one way or another. There was a need to provide a focus for professional development and the interchange of ideas, experiences, information, knowledge of analytical techniques and research outcomes.

The broad aim of AAIR is to benefit, assist and advance research leading to improved understanding, planning and operation of tertiary education institutions within Australasia. In pursuit of this aim, the specific objectives of AAIR are to:

(a) Raise the level of professional competence and practice in the fields of tertiary education institutional research, planning and analysis within the Australasian region.

(b) Promote inter-institutional cooperation between members in the undertaking of comparative institutional research projects.

(c) Aid the professional development of members.

(d) Organise an annual AAIR Conference.

(e) Develop and foster cooperative links with AIR.

(f) Encourage regional meetings to augment the annual AAIR conference activities.

(g) Carry out other activities that are incidental or conducive to the achievement of the above objectives.

In 1990, an Executive Committee was established to lead the progressive development of the Australasian Association for Institutional Research. This committee put major effort into attracting membership and promoting awareness of AAIR throughout the tertiary education sector within Australasia. To this end, the committee sponsored seminars and workshops in metropolitan locations aimed at enhancing the understanding of institutional research practices. An important initiative was the first AAIR Conference held at the University College of Central Queensland over 25 - 27 September 1990. The organisation of the second AAIR Conference held at Swinburne Institute of Technology over 1-3 October 1991, is the second major effort undertaken by the Executive Committee. In this endeavour, the Executive Committee worked in collaboration with the Conference Committee established at the host institution, Swinburne Institute of Technology.

The annual Conference is a vital element in the achievement of AAIR's basic purpose. The meetings provide a real opportunity within Australasia for persons interested in institutional research to take part in a program dedicated to topics directly relevant to their professional concerns. The conference works towards a comprehensive coverage of current issues, concepts and techniques concerned with planning, data analysis and research and related aspect of management support in tertiary education. At the same time, informal opportunities exist for colleagues to make new contacts and exchange experiences and perspectives in shared professional areas.

The Australasian AIR has attracted a membership of approximately 150 individual and corporate members. Most members are from Australia and New Zealand. Others are from Hong Kong, Singapore, Taiwan, Japan, Europe and the United States of America. AAIR's rapid increase in membership in a relatively short period of time since its foundation is encouraging. Membership strength is now sufficient to enable AAIR to function as a viable professional association.

AAIR encourages the spirit of cooperation amongst its members in the conduct of institutional research. AAIR members have undertaken a number of research and consultancy projects such as studies of relative costs of teaching in higher education, distance education, cost relativities and in-house monitoring of completion rates. Some of these are DEET funded. The publication of an AAIR journal, Higher Education And Decision Support (HEADS) is now in the process of development.

The 1992 AAIR conference will be hosted by Auckland Institute of Technology in New Zealand. The theme of this conference is 'Futures Scanning: Planning for Excellence in Tertiary Education'.

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